

**SECOND FIVE-YEAR REVIEW REPORT FOR  
OPERABLE UNITS 2 AND 4  
SCHOFIELD ARMY BARRACKS,  
SITES 12 AND 19  
OAHU, HAWAII**

**September 2007**



**U.S. Army Environmental Command  
Building E4460  
Aberdeen Proving Ground, Maryland 21010-5401**



**Directorate of Public Works  
United States Army Garrison, Hawaii  
572 Santos Dumont Avenue  
Building 105, Wheeler Army Airfield  
Schofield Barracks, Hawaii 96857-5013**

**Contract No.: W91ZLK-05-D-0009  
Delivery Order 0004**

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September 2007

Prepared for:



**U.S. Army Environmental Command  
Building E4460  
Aberdeen Proving Ground, Maryland 21010-5401**

and



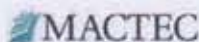
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Matthew T. Margotta, Colonel, U.S. Army  
Commander, U.S. Army Garrison, Hawaii

24 OCT 2007  
Date



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX  
75 Hawthorne Street  
San Francisco, CA 94105

September 24, 2007

Colonel Matthew T. Margotta  
Commander, US Army Garrison, Hawaii  
IMPC-HI-ZA  
851 Wright Avenue, WAAF  
Schofield Barracks, HI 96857-5000

Re: USEPA Concurrence on the Army's Second 5-Year Review of the CERCLA Clean-up at Schofield Army Barracks

Dear Colonel Margotta,

EPA has reviewed the Army's report on the Five-Year Review of the CERCLA Clean-up at Schofield Army Barracks and we concur with the Army's conclusion that the remedies for groundwater and the landfill are functioning properly and are protective of human health and the environment. We have inspected the minor repair work that the Army performed on the landfill cover and found that the repairs were complete and will serve to adequately limit erosion and infiltration in the future. The report is well written and complies with the requirements in EPA regulations and guidance documents.

We concur with the Army's recommendation to reduce the monitoring frequency at four wells to annual based on the fact that these wells have had stable or slightly decreasing concentration levels over the last ten years. We also concur with the Army's proposal to discontinue landfill gas monitoring. The landfill ceased operations over thirty years ago and the methane concentrations in the monitoring system were measured to be greater than zero in only a single quarterly monitoring event over the past five years. The concentration in that one event was well below the 5 percent methane concentration limit.

Please call me at (415) 972-3438 or Mark Ripperda of my staff at (415) 972-3028 if you have any questions concerning the Five-Year review.

Sincerely,

Michael M. Montgomery  
Chief, Federal Facilities and Site Cleanup Branch  
U.S. Environmental Protection Agency, Region IX

cc: Ukris Wongse-Ont, HDOH

# CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>ES-1</b>
<b>1.0 INTRODUCTION .....</b>	<b>1-1</b>
1.1 Purpose .....	1-1
1.2 Authority .....	1-2
1.3 Organizations and Agencies Involved .....	1-2
1.4 Overview of Schofield Barracks .....	1-3
1.4.1 Operable Unit 2.....	1-3
1.4.2 Operable Unit 4.....	1-4
1.5 Report Organization.....	1-4
<b>2.0 SITE CHRONOLOGY .....</b>	<b>2-1</b>
<b>3.0 BACKGROUND .....</b>	<b>3-1</b>
3.1 Physical Characteristics .....	3-1
3.2 Land and Resource Use .....	3-2
3.3 History of Contamination .....	3-2
3.4 Initial Response.....	3-4
3.5 Basis for Taking Action .....	3-4
<b>4.0 REMEDIAL ACTIONS .....</b>	<b>4-1</b>
4.1 Operable Unit 2 Remedial Actions .....	4-1
4.1.1 Operable Unit 2 Remedial Action Objectives .....	4-1
4.1.2 Selected Remedy for Operable Unit 2 .....	4-1
4.1.3 Operable Unit 2 Remedy Implementation .....	4-4
4.1.4 Operable Unit 2 System Operations and Maintenance .....	4-4
4.1.4.1 Long-term Groundwater Monitoring Program .....	4-4
4.1.4.2 Schofield Barracks Water Treatment Plant Operation and Maintenance .....	4-5
4.1.4.3 Del Monte Air Stripper Treatment System Operation and Maintenance .....	4-6
4.2 Operable Unit 4 Remedial Actions .....	4-6
4.2.1 Operable Unit 4 Remedial Action Objectives .....	4-6
4.2.2 Selected Remedy for Operable Unit 4 .....	4-7
4.2.3 Operable Unit 4 Remedy Implementation .....	4-7
4.2.4 Operable Unit 4 System Operations and Maintenance .....	4-8

<b>5.0</b>	<b>PROGRESS SINCE LAST FIVE-YEAR REVIEW</b>	<b>5-1</b>
5.1	Progress for Operable Unit 2	5-1
5.1.1	Protectiveness Statements from First Five-Year Review	5-1
5.1.2	Status of Recommendations and Follow-up Actions from First Five-Year Review	5-2
5.1.3	Results of Implemented Actions	5-3
5.2	Progress for Operable Unit 4	5-4
5.2.1	Protectiveness Statements from First Five-Year Review	5-4
5.2.2	Status of Recommendations and Follow-up Actions from First Five Year Review and Results	5-4
<b>6.0</b>	<b>FIVE-YEAR REVIEW PROCESS AND FINDINGS</b>	<b>6-1</b>
6.1	Operable Unit 2 Document and Data Review and Findings	6-1
6.1.1	Operable Unit 2 Historical Document Review	6-1
6.1.1.1	Operable Unit 2 Record of Decision	6-2
6.1.1.2	Five-Year Review Guidance Document	6-3
6.1.1.3	Operation and Maintenance and Long-Term Groundwater Monitoring Plan	6-3
6.1.2	Operable Unit 2 Recent Document Review, Data Evaluations, and Findings	6-4
6.1.2.1	Review of Quarterly Groundwater Monitoring Reports and Analytical Data Evaluation	6-5
6.1.2.2	Regulatory Correspondence	6-7
6.1.2.3	Fact Sheet Regarding Groundwater Modeling	6-8
6.2	Operable Unit 2 Remedy Inspections	6-8
6.2.1	Onpost Groundwater Monitoring Wells	6-8
6.2.2	Schofield Barracks Water Treatment Plant	6-9
6.2.3	Del Monte Air Stripper Treatment System	6-9
6.2.4	Recommendations for Optimization	6-9
6.3	Operable Unit 4 Document and Data Review and Findings	6-9
6.3.1	Operable Unit 4 Historical Document Review	6-10
6.3.2	Recent Document Review and Findings	6-11
6.3.2.1	Quarterly Landfill Gas Monitoring Reports	6-11
6.3.2.2	Quarterly Landfill Inspection Reports	6-12
6.3.3	Operable Unit 4 Remedy Inspection	6-14
6.3.4	Recommendations for Optimization	6-15
6.4	Community Relations for Operable Unit 2 and Operable Unit 4	6-15
<b>7.0</b>	<b>TECHNICAL ASSESSMENT</b>	<b>7-1</b>
7.1	Operable Unit 2 Remedy Evaluation	7-1
7.1.1	Evaluation of the Remedy for Operable Unit 2	7-1
7.1.2	Evaluation of Previous Assumptions for Operable Unit 2	7-1
7.1.3	Evaluation of Effectiveness/Protectiveness of Operable Unit 2	7-2
7.2	Operable Unit 4 Remedy Evaluation	7-2
7.2.1	Evaluation of the Remedy for Operable Unit 4	7-2
7.2.2	Evaluation of Previous Assumptions for Operable Unit 4	7-4
7.2.3	Evaluation of Effectiveness/Protectiveness of Operable Unit 4	7-5
7.3	Summary of Technical Assessment	7-6

<b>8.0</b>	<b>ISSUES REGARDING REMEDIAL MEASURES</b> .....	8-1
8.1	Issues Regarding Operable Unit 2 .....	8-1
8.2	Issues Regarding Operable Unit 4 .....	8-1
<b>9.0</b>	<b>RECOMMENDATIONS AND FOLLOW-UP ACTIONS</b> .....	9-1
9.1	Recommendations and Follow-up Actions for Operable Unit 2.....	9-1
9.1.1	Groundwater Sampling Contingency Plan.....	9-1
9.1.2	Changes in Monitoring Frequency .....	9-2
9.2	Recommendations and Follow-up Actions for Operable Unit 4.....	9-3
<b>10.0</b>	<b>PROTECTIVENESS STATEMENTS</b> .....	10-1
10.1	Effectiveness of Current Measures for Operable Unit 2.....	10-1
10.2	Effectiveness of Current Measures for Operable Unit 4.....	10-1
<b>11.0</b>	<b>NEXT REVIEW</b> .....	11-1
<b>12.0</b>	<b>ACRONYMS AND ABBREVIATIONS</b> .....	12-1
<b>13.0</b>	<b>REFERENCES</b> .....	13-1

## TABLES

4.1	Long-Term Groundwater Monitoring Well Network
4.2	Operation and Maintenance Cost for Operable Unit 2, Fiscal Years 2002 through 2006
4.3	Changes in Monitoring Frequency, Long-Term Groundwater Monitoring Program for OU 2 and OU 4
4.4	Operation and Maintenance Cost for Operable Unit 4, Fiscal Years 2002 through 2006
6.1	Summary of Groundwater Sampling Events Performed During Second Five-Year Review Period
6.2	Network Wells Not Sampled During Five-Year Review Period
6.3	Long-Term Groundwater Monitoring Wells Trend Evaluation, Second Five-Year Review Period
6.4	Summary of Landfill Quarterly Inspection Reports Observations, December 2001 through December 2006
8.1	Issues Regarding Remedies for Operable Unit 2 and Operable Unit 4
9.1	Contingency Plan for Sampling Wells in Long-Term Monitoring Network
9.2	Recommendations for Changes in Monitoring Frequency
9.3	Recommendations and Follow-up Actions for Operable Unit 2 and Operable Unit 4

## FIGURES

3.1	Site Location Map of Schofield Army Barracks
3.2	Regional Groundwater Systems of Oahu, Hawaii
3.3	Trichloroethene and Carbon Tetrachloride Analytical Results in Groundwater Collected from Schofield Barracks Water Supply Wells and OU2 and 4 Monitoring Wells
3.4	Trichloroethene and Carbon Tetrachloride Analytical Results in Groundwater Collected from Offsite Production and Irrigation Wells

- 4.1 Evaluation for Potential Wellhead Groundwater Treatment
- 4.2 Assessment of Changes in Monitoring Frequency

## APPENDIXES

- A OPERABLE UNIT 2 SCHOFIELD ARMY BARRACKS WATER TREATMENT SYSTEM DESCRIPTION
- B LIST OF DOCUMENTS REVIEWED FOR FIVE-YEAR REVIEW PROCESS
- C APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
- D TIME VERSUS CONCENTRATION PLOTS FOR TRICHLOROETHENE AND CARBON TETRACHLORIDE
- E PUBLIC FACT SHEETS
- F OPERABLE UNIT 2 AND OPERABLE UNIT 4 SITE INSPECTION CHECKLISTS
- G TIME VERSUS CONCENTRATION PLOTS FOR LANDFILL GAS DATA
- H LANDFILL INSPECTION REPORTS, DECEMBER 2001 TO OCTOBER 16, 2006
- I SITE INSPECTION PHOTOGRAPHS OF LANDFILL COVER

## EXECUTIVE SUMMARY

This report documents the second five-year review conducted for Schofield Army Barracks, Oahu, Hawaii, (Schofield Barracks) and evaluates the protectiveness of the implemented remedies for Operable Unit (OU) 2 (Groundwater) and OU 4 (Former Landfill) at Schofield Barracks. This five-year review covers the period from November 1, 2002 through September 30, 2007. OU 1 and OU 3 were approved for no further action during the OU 1 and OU 3 Remedial Investigations (RIs) and thus do not require five-year reviews.

The OU 2 remedy primarily consists of the following components:

- Wellhead treatment of extracted groundwater for domestic and municipal use that exceeds the Maximum Contaminant Levels (MCLs) for trichloroethene (TCE) and carbon tetrachloride (CCl<sub>4</sub>) at the Schofield Barracks Supply Wells and Del Monte-owned Well 3-2803-05
- Long-term groundwater monitoring to identify increasing concentrations of TCE and CCl<sub>4</sub> (contaminants) in groundwater to allow the Army to procure funds for and institute wellhead treatment of domestic use groundwater before contaminant concentrations reach the MCLs
- Conducting five-year reviews

The treatment portion of the remedy was implemented before the Record of Decision (ROD) was approved in September 1996 (i.e., in 1986), and an interim long-term monitoring program was initiated in June 1996. The long-term monitoring program for OU 2 was implemented in April 1997 and continues to the present (2007). Operation and maintenance (O&M) costs for wellhead treatment at the Del Monte well are reimbursed by the Army.

The OU 4 remedy consists of the following components:

- Regrading and repairs to the existing landfill cover system
- Maintenance of the existing landfill cover and venting system
- Restricted access to the former landfill

- Long-term groundwater and landfill gas monitoring
- Conducting five-year reviews

Implementation of the selected remedy for OU 4 occurred in several construction phases. The trigger for this five-year review was the start of OU 4 remedy construction on March 10, 1997. OU 4 achieved construction completion when the final inspection was performed on July 21, 1998. Landscaping activities were completed on August 7, 1998. O&M activities have been conducted since the completion of the remedy, and include general inspections, general maintenance, groundwater and landfill gas monitoring, record keeping, and reporting.

Conclusions and recommendations related to this five-year review are included in the Five-Year Review Summary Form, which is included in this executive summary. This second five-year review identified that the remedies are in accordance with the requirements of the OU 2 ROD and the OU 4 ROD. The remedies are functioning as designed and continue to be protective of human health and the environment as demonstrated by quarterly groundwater and landfill gas monitoring results and quarterly inspection of the former landfill. Results from the monitoring well network show that the plumes are not migrating downgradient. The quarterly landfill gas monitoring program is recommended to be discontinued, as methane concentrations in the gas monitoring probes in the past ten years have been far less than the 5 percent limit defined by the State.

The Army will continue to maintain and operate the groundwater treatment systems and the monitoring well network until TCE and CCl<sub>4</sub> MCLs are achieved in groundwater, and the Army will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. The Army will also continue maintenance of the landfill cover system and institutional controls to prevent the contact of contents with human receptors or the environment. Therefore, the remedies continue to be effective and protective.

The next five-year site review is scheduled to begin by March 2012.

## Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from CERCLIS): Schofield Army Barracks		
EPA ID (from CERCLIS): HI7210090026		
Region: IX	State: HI	City/County: Wahiawa/Honolulu County
SITE STATUS		
NPL status: <input type="checkbox"/> Final <input checked="" type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Multiple OUs?* <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Construction completion date: <u>7/21/1998</u>
Has site been put into reuse? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO (The Site remains an active Army base)		
REVIEW STATUS		
Lead agency: <input type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input checked="" type="checkbox"/> Other Federal Agency <u>U.S. Army</u>		
Author name: MACTEC Engineering and Consulting; ECC		
Author title:		Author affiliation: Consultant
Review period:** <u>10/01/2002</u> to <u>09/30/2007</u>		
Date(s) of site inspection: <u>February 21, March 1, and March 15, 2007</u>		
Type of review: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input checked="" type="checkbox"/> Post-SARA</span> <span><input type="checkbox"/> Pre-SARA</span> <span><input type="checkbox"/> NPL-Removal only</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input type="checkbox"/> Non-NPL Remedial Action Site</span> <span><input type="checkbox"/> NPL State/Tribe-lead</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input type="checkbox"/> Regional Discretion</span> </div>		
Review number: <input type="checkbox"/> 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input type="checkbox"/> Actual RA Onsite Construction at OU #_____</span> <span><input type="checkbox"/> Actual RA Start at OU#_____</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input type="checkbox"/> Construction Completion</span> <span><input checked="" type="checkbox"/> Previous Five-Year Review Report</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input type="checkbox"/> Other (specify)</span> </div>		
Triggering action date (from CERCLIS): <u>9/30/2002</u>		
Due date (five years after triggering action date): <u>9/30/2007</u>		

\* ["OU" refers to operable unit.]

\*\* [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

## Five-Year Review Summary Form, cont'd.

### Issues:

#### Operable Unit 2:

- The dedicated submersible pump in Monitoring Well MW 2-1 (3-2900-02) was inoperative when the well was inspected in February 2007. Repairs to the pump have been made.
- The concentrations and distribution of TCE and CCl<sub>4</sub> contamination in the Schofield High-Level Aquifer have changed very little in the past five years. Trends in concentrations indicate slight, gradual changes or no change for most wells. The relative stability of the concentrations over time suggests that lower monitoring frequencies for some wells may be sufficient to assure protectiveness of the remedy.
- The TCE concentration in Well 3-2901-13 increased to greater than 2.5 µg/l for one sampling event. This location is an onpost monitoring well and, as such, the increase does not pose a risk. Increasing the monitoring frequency may be considered if concentrations remain above 2.5 µg/l in the next sampling event.
- Well 3-2803-01 was incorrectly identified during three monitoring events in 2005 and was not sampled.
- Well 3-2803-01 has been incorrectly identified. The well being sampled is actually Well 3-2803-03.
- Several wells were not sampled during the 5-year review period due to inoperable pumps or access problems. DOH requested that a contingency plan be developed for sampling all wells in the long-term monitoring network as part of this five-year review. This plan is presented in Section 9.0.

#### Operable Unit 4:

- Cracking of the cover in many areas of the landfill due to settlement and dessication during dry periods.
- Minor erosion and some cracking of the cement in the cement rubble masonry are evident in the Center Drainage Channel of the landfill.
- Several new small trees growing on the cap; these do not include the 20-25 year old, large tree in the northern area of the landfill.
- Extensive growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap.
- Several isolated barren areas throughout the landfill.
- Areas of erosion under the north and east fence and two areas where trees are entangled in the fence.
- Slight erosion around the concrete footings of numerous fence posts, and there is one slightly damaged post.
- The protective surface housings for the four landfill gas monitoring wells are slightly deteriorating.

## **Recommendations and Follow-up Actions:**

### Operable Unit 2:

- The pump in Monitoring Well MW 2-1 (3-2900-02) was repaired on May 3, 2007. These repairs restored the well to service for sample collection.
- Monitor the TCE concentrations in Well 3-3004-01 to assess increasing the monitoring frequency if the concentration reaches 30 µg/l.
- Correct the name of Well 3-2803-01 to 3-2803-03 in future sampling events and in the database.
- Developed a contingency plan for sampling all wells in the long-term groundwater monitoring program. The plan is presented in Section 9.1.1.
- Recommended changes in groundwater monitoring frequency are presented in Section 9.1.2.

### Operable Unit 4:

- Repair cracks in the landfill cover when they are observed.
- Take measures to address the slight erosion and cracked concrete evident in the Center Drainage Channel of the landfill. The cracked concrete should be repaired, and recommendations for addressing the erosion include one of the following: (1) regrading/revegetating, (2) installment of permanent erosion matting, or (3) placement of riprap along affected areas.
- Repair any corroded protective surface housings for the four groundwater monitoring wells at the landfill.
- Remove new small trees growing on the cap. Note that this does not include the large, 20-25 year old tree near the northwest perimeter of the landfill. A decision was made, with the concurrence of the Army, to leave the large tree.
- Manage growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap with herbicides, followed by revegetation with native grasses or using procedures that are in accordance with the O&M plan.
- Fill in eroded areas under fence with soil or rock and remove trees entangled in the fence.
- Fill in eroded areas around the concrete footings of fence posts, and replace or repair damaged post.
- Eliminate quarterly landfill gas monitoring. The methane concentrations in the gas probes were measured to be greater than zero in only one monitoring event in the past five years, and the methane concentrations in that one event were far less than the 5 percent methane concentration limit. Continuing the landfill gas monitoring is unnecessary and discontinuing the monitoring would not affect protectiveness.

**Protectiveness Statements:**

The primary RAO for the OU 2 implemented remedy was to protect human health and the environment by limiting contact with groundwater exceeding the MCLs. Human health is protected by using air strippers to treat groundwater from supply wells with concentrations above the MCLs (the four Schofield Barracks Supply Wells and Del Monte Well 3-2803-05). The treatment systems are fully operational and functional and treat groundwater to remove contaminants to levels an order of magnitude below MCLs. Results from the monitoring well network show that the plume is not migrating downgradient. The Army will continue to maintain and operate the treatment systems and the monitoring well network until TCE and CCl<sub>4</sub> MCLs are achieved in groundwater, and will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. Therefore, the remedy continues to be effective and protective.

The primary RAO for the OU 4 implemented remedy was to protect human health and the environment by limiting direct contact with the Former Landfill contents and by restricting surface-water infiltration through the landfill. Construction and implementation of the landfill cover met the first half of the RAO by limiting direct contact with the Former Landfill contents. Continued repair and maintenance of the OU 4 remedy will continue to comply with the second half of the RAO by restricting surface-water infiltration through the landfill. Therefore, the remedy continues to be effective and protective.

**Other Comments:**

None

## 1.0 INTRODUCTION

This five-year review of Schofield Barracks, Operable Unit (OU) 2 and OU 4 was conducted by MACTEC Engineering and Consulting, Inc. (MACTEC) for the U.S. Army Garrison Hawaii (Army), under subcontract agreement 5404.004.337890 to ECC, the Prime Contractor for this project. This five-year review report was prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the National Contingency Plan (NCP), and the Comprehensive Five-Year Review Guidance Document (United States Environmental Protection Agency [EPA], 2001).

This report is the second five-year review for Schofield Barracks OU 2 and OU 4, which covers the period from November 1, 2001 to December 31, 2006, pursuant to the OU 4 Record of Decision (ROD) (Harding Lawson Associates [HLA], 1996c) and the OU 2 ROD (HLA, 1996d). The first five-year review report covered the period from March 1997 to September 2001 and was completed by Harding ESE (2002). It was approved by the Army in September 2002.

The following subsections present the purpose, authority, organizations and agencies involved in this review, a description and status of the OUs, and report organization.

### 1.1 Purpose

The purposes of this five-year review for Schofield Barracks OU 2 and OU 4 are to:

- Evaluate whether the implemented remedies described in the OU 2 ROD (HLA, 1996d) and the OU 4 ROD (HLA, 1996c) are protective of human health and the environment as intended. Evaluation of the remedies is supported by observations, data, and interpretations within this report.
- Identify deficiencies or issues, if any, found during the review.
- Identify recommendations to address them.

## 1.2 Authority

The Army must implement five-year reviews in accordance with CERCLA and the NCP. CERCLA §121, as amended, states, “If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less than each five years after the initiation of such remedial action...” This requirement is further supported by NCP; 40 Code of Federal Regulations (CFR) 300.430(f)(4)(ii), which states, “If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.”

## 1.3 Organizations and Agencies Involved

The Army is the lead agency under CERCLA and is conducting the five-year review. The EPA and the Hawaii Department of Health (DOH) are the regulatory agencies responsible for reviewing the five-year review report. Harding ESE/MACTEC conducted groundwater monitoring for OUs 2 and 4 from November 2001 through December 2004. Versar, Inc. (Versar) conducted groundwater monitoring from March 2005 through December 2006. Groundwater monitoring was conducted in accordance with the Final Operation and Maintenance, and Long-Term Groundwater Monitoring Plan for OU 2 (HLA, 1996e).

Quarterly landfill inspections are performed in compliance with the Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4 (OU 4 O&M Plan) (HLA, 1996f). The U.S. Army Directorate of Public Works (DPW) at Schofield Barracks conducted these landfill inspections from 1997 (since OU4 remedial action initiated) through December 2004, and Versar conducted the inspections from March 2005 through October 2006. In addition to these quarterly site inspections, quarterly landfill gas monitoring is conducted for OU 4. Landfill gas monitoring was conducted by Harding ESE/MACTEC from November 2001 through August 2004 and by Versar from March 2005 through October 2006.

## 1.4 Overview of Schofield Barracks

Four OUs were established to address the potential areas of contamination at Schofield Barracks:

- OU 1 – Possible TCE Sources
- OU 2 – Groundwater Contamination
- OU 3 – Remaining Onpost Sites Suspected to Contain Contamination Sources
- OU 4 – Former Schofield Barracks Landfill

OU 2 and OU 4 proceeded through the CERCLA process and are included in this five-year review. OU 1 and OU 3 required no further action following the RIs because no onpost sources of TCE contamination were found. Therefore, they are not included as part of this five-year review. The following subsections provide descriptions of OUs 2 and 4.

### 1.4.1 Operable Unit 2

OU 2 consists of the groundwater beneath Schofield Barracks, which is contaminated primarily with trichloroethene (TCE) and carbon tetrachloride (CCl<sub>4</sub>). This groundwater is 550 to 650 feet below ground surface (bgs) and is part of the groundwater body known as the Schofield High-level Water Body. It is called a "high-level" water body because the groundwater levels beneath Schofield Barracks are much higher than groundwater levels in the nearby coastal areas because of underground geologic structures that act as dams to groundwater flow. Most of the groundwater beneath Schofield Barracks originates as rainfall in the Koolau and Waianae mountain ranges to the east and west. This rainfall seeps into the ground in the mountain areas and moves through the subsurface eventually reaching Schofield Barracks. A small amount of water also seeps into the ground in the Schofield Barracks area and reaches the underlying groundwater. The groundwater beneath Schofield Barracks eventually flows over the northern and southern groundwater dams into the coastal water bodies to the north and south.

Groundwater data collected during the OU 2 Remedial Investigation (RI) suggest that at least two separate TCE and CCl<sub>4</sub> sources exist. It is likely that the TCE migrated from these ground surface locations through the soil and bedrock to the underlying groundwater. The Former Landfill (OU 4) was identified as the source of the TCE and CCl<sub>4</sub> in the groundwater underlying that site. The Schofield Barracks water supply wells are currently extracting groundwater containing TCE and CCl<sub>4</sub> from the groundwater beneath Schofield Barracks (OU 2) and treating the extracted water via air stripping at the Schofield Barracks Water Treatment Plant (WTP) to reduce the TCE and CCl<sub>4</sub> concentrations to EPA maximum contaminant levels (MCLs) before the water is distributed for human use. The source for the TCE contamination in the Schofield Barracks water supply wells is suspected to be somewhere in the Schofield Barracks East Range, but was not found after extensive investigative effort. This source investigation was performed under the OU1 RI (HLA, 1995b., Section 1.4.1).

### 1.4.2 Operable Unit 4

OU 4 consists of a former landfill located on Schofield Barracks. The former landfill was constructed in approximately 1942 and remained operational until December 1981. The former landfill encompasses approximately 35 acres, is covered with a soil cap, and does not contain a bottom or top liner system. The landfill contents consist of a variety of solid wastes (primarily domestic waste from base housing), industrial wastes (vehicle and equipment maintenance waste, sewage sludge, solvents, waste), medical wastes, and construction and demolition waste from various military installations on Oahu. In addition, ordnance explosives and unexploded ordnance have been identified in the landfill contents.

### 1.5 Report Organization

This report documents and evaluates observations and data for OU 2 and OU 4 obtained from historical documents prepared prior to the signing of the RODs, and review of recent regulations, documents, and data collected subsequent to the ROD approval as part of the five-year review. This report is divided into thirteen sections. Section 1.0 presents the purpose and authority for conducting the review, the organizations involved, and definitions of the OUs. Section 2.0 presents the site chronology. Section 3.0

presents background information. Section 4.0 presents the remedial actions taken for each OU. Section 5.0 describes the progress made since the remedy implementation. Section 6.0 presents the five-year review process and its findings. Section 7.0 presents a technical assessment of the review findings. Section 8.0 presents issues associated with each OU, and Section 9.0 presents recommendations and follow-up actions. Section 10.0 presents protectiveness statements, and Section 11.0 describes the schedule for the next review. Section 12.0 presents acronyms and abbreviations, and Section 13.0 presents references.



## 2.0 SITE CHRONOLOGY

A chronology of events and public relations activities related to the OU 2 and OU 4 CERCLA programs is presented below. The events and activities listed span the period from the discovery of TCE in groundwater in 1985 until the present.

<b>CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4</b>	
<b>Event</b>	<b>Date</b>
Schofield Barracks issued a press release regarding the detection of TCE in the Schofield Barracks Supply wells and the temporary switch to city and county water supplies.	May 1985
Installation of air stripping treatment unit to treat water from Schofield supply wells	September 1986
Schofield Barracks issued a press release regarding the placement of the installation on the NPL.	August 1990
Schofield Barracks Public Affairs Office and Environmental Office addressed the Wahiawa Neighborhood Board regarding Army plans to conduct investigations on Schofield Barracks to identify sources of TCE.	October 1990
A Federal Facility Agreement (FFA) was negotiated among the EPA, the State of Hawaii, and the Army. The FFA identified Schofield Barracks as being under the jurisdiction, custody, or control of the U.S. Department of Defense and subject to the Defense Environmental Restoration Program. Four OUs were defined, including OU 2 (Groundwater) and OU 4 (Former Landfill).	September 1991
The work plan for the Preliminary Assessment/Site Investigation (PA/SI) for OUs 1, 2, and 4 was finalized and the PA/SI for OUs 1, 2, and 4 began.	November 1991
Schofield Barracks and U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) submitted press releases requesting public involvement in locating the source(s) of TCE contamination in and around Schofield Barracks.	January 1992
Schofield Barracks and USATHAMA conducted interviews with twenty local residents to assist in the development of a Community Relations Plan for the Schofield Barracks Installation Restoration Program (IRP).	January 1992
The PA/SI for OU 2 and OU 4 was completed.	May 1992
The Army finalized the Community Relations Plan for Schofield Barracks and placed copies in the newly established information repositories located in the Mililani Public Library, the Wahiawa Public Library, the Hawaii Department of Health, and the DPW in Building 300 of Wheeler Army Airfield.	June 1992
The work plans for the OU 2 and OU 4 Remedial Investigation/Feasibility Study (RI/FS) were finalized and the OU 2 and OU 4 RIs began.	January 1993
Schofield Barracks and United States Army Environmental Center (now Command) (USAEC) conducted a public meeting at the Hale Koa at Wahiawa District Park in Wahiawa to provide the public with an update on the IRP and the results of the first phase of the investigations.	February 1993
In conjunction with the public meeting, the Army published and distributed a fact sheet that provided an update on the IRP and initial investigative results.	February 1993

<b>CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4</b>	
<b>Event</b>	<b>Date</b>
Schofield Barracks and USAEC conducted public availability sessions at the Hale Koa at Wahiawa District Park and at the Schofield Barracks Post Library to provide an update on the IRP.	September 1994
In conjunction with the public availability sessions, the Army solicited interest in the formation of a Restoration Advisory Board (RAB) comprised of local citizen representatives, Army representatives, and regulatory agency representatives that would oversee the conduct of the Army's IRP at Schofield Barracks.	September 1994
The Army presented a poster display that summarized installation restoration efforts and plans for Schofield Barracks at the 1 <sup>st</sup> Hawaii National Technologies Conference sponsored by the Hawaii Department of Health.	September 1994
In conjunction with the public availability session, the Army published and distributed a fact sheet that provided an update on the IRP and initial investigative results.	September 1994
The RI/FS for OU 4 was completed.	December 1995
The RI/FS for OU 2 was completed.	February 1996
Schofield Barracks conducted a public review period for the OU 4 Proposed Plan.	April 1996
Schofield Barracks and USAEC conducted a public meeting to present the OU 4 Proposed Plan and solicit public comments.	May 1996
Schofield Barracks conducted a public review period for the OU 2 Proposed Plan.	May 1996
Schofield Barracks and USAEC conducted a public meeting to present the OU 2 Proposed Plan and solicit public comments.	June 1996
The OU 2 ROD and OU 4 ROD were approved.	September 1996
Submittal of Final Long-term Groundwater (LTGW) Monitoring Plan for OUs 2 and 4	September 1996
Implementation of the OU 2 interim monitoring program	September 1996
Implementation of the OU 2 Long-term Monitoring Program .	April 1997
Implementation of the OU 4 Long-term Monitoring Program	June 1998
Construction for OU 4 remedial action began.	March 1997
Final inspection for OU 4 remedial action was conducted.	July 1998
Schofield Barracks was removed from the NPL.	August 2000
Activities for First Five-Year Review for Schofield Barracks OUs 2 and 4 began.	August 2001
Submittal of Draft First Five-Year Review	December 2001
Approval of First Five-Year Review by Installation Commander	September 2002
Decrease sampling frequency of 13 OU 2 wells to annual and 7 OU 2 wells to semi-annual. Decrease sampling frequency of OU 4 Wells 3103-01, 2903-01, and 3004-05 from semi-annual to annual	October 2002
Decrease sampling frequency of OU 2 Wells 2901-13, 2959-01, 2802-01, and 2803-01 and OU 4 Well 3004-01 to annual	December 2005
Submittal of Addenda to the Final O&M and LTGW Monitoring Plans for OU 2 and OU 4	April 2006

<b>CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4</b>	
<b>Event</b>	<b>Date</b>
EPA approval of Addenda to the Final O&M and LTGW Monitoring Plans for OU 2 and OU 4	July 2006
Army published and distributed an information sheet providing a general description of the Site and a project summary of remedial measures	July 2006
Army published and distributed a Fact Sheet providing a summary of the results of a reevaluation of groundwater modeling performed as part of the Installation Restoration Program (IRP) at Schofield Barracks	November 2006
Activities for Second Five-Year Review for Schofield Barracks OUs 2 and 4 began.	January 2007



### 3.0 BACKGROUND

This section presents descriptions of the physical characteristics, land and resource use, general history and history of CERCLA-related events, and definitions of OUs at Schofield Barracks.

#### 3.1 Physical Characteristics

Schofield Barracks is located in the Schofield Plateau between the Waianae and Koolau Mountain Ranges in central Oahu (Figure 3.1). It is the Army's largest installation outside the continental United States. It currently serves primarily as the home of the 25th Infantry Division, whose mission it is to be prepared for deployment to a theater of operations to perform combat operations as part of a corps counterattack. On order, it conducts theater-wide deployment within 54 hours of notification to perform combat operations in support of USCINCPAC theater strategy. In support of this mission, the division's main activity is training. Installation facilities include a medical facility, community and housing support facilities, and transportation and repair facilities.

The groundwater body underlying the Schofield Plateau is known as the Schofield High-level Water Body (Figure 3.2). The water table (potentiometric surface) elevation of the Schofield High-level Water Body is approximately 275 feet above mean sea level. This elevation is lower than the adjacent dike-impounded water bodies to the east (Koolau Mountain Range) and west (Waianae Mountain Range) and higher than the basal water bodies to the north (Waialua Basal Water Body) and south (Honolulu-Pearl Harbor Basal Water Body) that have elevations of less than 50 feet above mean sea level.

The northern and southern boundaries of the Schofield High-level Water Body (characterized as groundwater dams) have been inferred from water-level measurements in domestic and irrigation wells on either side of the groundwater dams and by geophysical surveys. The dams impede groundwater flow to the

Honolulu-Pearl Harbor and Waialua Basal Water Bodies. However, the nature and locations of these water body boundaries are not precisely known.

### 3.2 Land and Resource Use

The property incorporated within the Schofield Barracks Main Post, the Schofield Barracks East Range, and Wheeler Army Airfield are owned and operated by the Army as active military installations. The towns of Wahiawa and Mililani, other military properties, and private properties are adjacent to Schofield Barracks or in the surrounding vicinity. Some of the private properties are used for agricultural purposes such as growing sugar cane and pineapples.

Groundwater is the principal source of drinking water for the population of Oahu and is the source of fresh water for other uses. Most of the groundwater wells in the Schofield Barracks area are used as municipal water supplies or have irrigation uses.

### 3.3 History of Contamination

Schofield Barracks was originally established in 1908 as a base for the Army's mobile defense of Pearl Harbor and the Island of Oahu. It served as a major support facility during World War II, temporarily housing more than one million troops. It also served as a support and training facility during the Korean and Vietnam wars. Since the Vietnam War, it has served primarily as a training facility.

In 1985, TCE, a commonly used cleaning solvent, was detected in groundwater from the Schofield Barracks water-supply wells. The source of the TCE contamination could not be identified; however, it is likely that the TCE migrated from one or more ground surface locations through the soil and bedrock to the underlying groundwater.

The Former Landfill was an open burn dump from approximately 1942 until 1967, when it was converted to a sanitary landfill in response to provisions of the Clean Air Act (Ecology and Environment, Inc.,

1981; Kennedy Engineers, 1980). The Former Landfill was used to dispose of a wide variety of solid wastes from various military installations, of which the major contributors were Schofield Barracks, Wheeler Air Force Base (currently Wheeler Army Airfield), and the Wahiawa Radio Station (U.S. Army Support Command, Hawaii, 1983; Kennedy Engineers, 1980). Most of the waste deposited in the landfill was domestic refuse from the surrounding base housing (Ecology and Environment, Inc., 1981); however, wastes were also disposed from various industrial operations (e.g., vehicle and equipment maintenance and construction). Tripler Army Medical Center (TAMC) reportedly contributed medical wastes including pathogenic, infectious, and pharmaceutical (expired and unusable drugs) wastes (Ecology and Environment, Inc., 1981; Kennedy Engineers, Inc., 1980).

Other materials reportedly disposed in the Former Landfill were organic solvents, sewage sludge, asbestos, pesticide containers, unusable paints, metallic debris, vegetation, and tree stumps (Environmental Science and Engineering, 1984). Hazardous materials, including live munitions, acids, and solvents, were also reported to have been dumped in the landfill (Asquith, 1982; Kennedy Engineers, 1980). HLA personnel interviewed Mr. Steve Kim, Directorate of Health Services, TAMC, on December 6, 1991. Mr. Kim reported that a mortar round and a rocket casing had been excavated from the landfill in the past. In addition, Ecology and Environment, Inc., (1981) reported that 90-millimeter (mm) shells exploded onpost when they were struck by a landfill tractor. The EPA Field Investigation Team report (Ecology and Environment, Inc., 1981) cited two explosions of drummed material labeled methyl ethyl ketone, and indicated that an area may exist where 20- to 25-gallon glass containers containing concentrated sulfuric acid are buried. No records were available concerning the types, amounts, or volumes of wastes disposed at the Former Landfill, but the rate has been estimated at 100 tons per day (Kennedy Engineers, 1980).

### 3.4 Initial Response

In September 1986, the Army installed an air stripping treatment unit to remove the TCE from the water prior to use in the water-supply system. In 1987, EPA established a MCL for TCE of 5 parts per billion (ppb) in drinking water. TCE has not been detected above this limit in the treated groundwater from the Schofield Barracks water-supply wells.

As a result of the detection of TCE in the water from the onpost water-supply wells, Schofield Barracks was placed on the National Priorities List (NPL) in August 1990. The NPL is a list of sites, developed by the EPA, which pose a risk to public health or the environment. Section 120 of CERCLA requires federal facilities to investigate and remediate past releases of hazardous wastes that pose a risk.

### 3.5 Basis for Taking Action

The discovery of the presence of TCE in the Schofield Barracks water supply initiated the CERCLA process at Schofield Barracks. In May 1985, Schofield Barracks issued a press release regarding the detection of TCE in the Schofield Barracks Supply wells and the temporary switch to city and county water supplies. In September 1986 an air stripping treatment unit was installed to treat water from Schofield supply wells. In August 1990, Schofield Barracks issued a press release regarding the placement of the installation on the NPL. A Federal Facility Agreement (FFA) was negotiated among EPA, the State of Hawaii, and the Army in September 1991. The FFA identified Schofield Barracks as being under the jurisdiction, custody, or control of the U.S. Department of Defense and subject to the Defense Environmental Restoration Program. Four OUs were defined, including OU 2 (Groundwater) and OU 4 (Former Landfill).

Groundwater was extensively sampled between 1993 and 1996 during preparation of the Draft Final OU 2 RI Report, Schofield Barracks, (OU 2 RI) (HLA, 1996b) and the Final Feasibility Study Report for OU 2, Schofield Barracks, (OU 2 FS) (HLA, 1996a) to characterize the nature and extent of

contamination in groundwater in the Schofield Barracks and Wheeler Army Airfield area. The only analytes detected above MCLs in the groundwater system beneath Schofield Barracks and Wheeler Army Airfield were TCE, CCl<sub>4</sub>, antimony, and manganese. Other chlorinated volatile organic compounds (VOCs), such as tetrachloroethene (PCE), were detected in some wells at very low concentrations (less than MCLs). Contaminants were detected in two plume areas: (1) beneath the Former Landfill area and (2) beneath the Schofield Barracks East Range and Wheeler Army Airfield (East Range/Wheeler) area. TCE was the only contaminant detected in the East Range/Wheeler plume area and was also detected in the vicinity of the Former Landfill. Figure 3.3 shows the distribution and concentrations over time of TCE and CCl<sub>4</sub> in onpost wells, and Figure 3.4 shows concentrations over time and the distribution in offpost wells.

The horizontal extent of CCl<sub>4</sub>, antimony, and manganese contamination was limited to the immediate vicinity of the Former Landfill. The inorganic analytes antimony and manganese were detected above MCLs inconsistently. Because of this inconsistency and because these inorganic analytes were not detected above MCLs during later RI/FS sampling events, the detections of antimony and manganese above MCLs were believed to be anomalous. Therefore, only TCE and CCl<sub>4</sub> were retained as chemicals addressed in the OU 2 FS.

The results of the OU 4 RI (found in the OU 4 FS) (HLA, 1995a) indicate that TCE and CCl<sub>4</sub> are present within the landfill contents and suggest that they have leached downward to the water table via infiltration and percolation. Thus, the remedial action objectives (RAOs) for OU 4 included controlling this apparent TCE and CCl<sub>4</sub> source by mitigating water infiltration and migration through the landfill contents.



## 4.0 REMEDIAL ACTIONS

This section presents the RAOs and the remedies selected and implemented for OU 2 and OU 4 at Schofield Barracks.

### 4.1 Operable Unit 2 Remedial Actions

The RAOs and remedy selected and implemented for OU 2 are summarized in the following subsections.

#### 4.1.1 Operable Unit 2 Remedial Action Objectives

The RAOs for OU 2 (HLA, 1996a) are the following:

- Mitigate the risk to human health and the environment from potential exposure to contaminated groundwater.
- Satisfy state and federal Applicable or Relevant and Appropriate Requirements (ARARs).

In the preparation of the OU 2 FS (HLA, 1996a), a comparison between aquifer cleanup and point-of-use groundwater treatment was made. Because of the great depth to groundwater (700 feet or more), it was determined to be impracticable to remediate the water in the Schofield High Level Water Body. A point-of-use treatment approach is feasible and protective because the only route of exposure to water in the aquifer is through withdrawal of the water from wells. It was determined to be much more cost effective to treat the groundwater at the point of withdrawal for consumptive use. A technical impracticability (TI) waiver was prepared (EPA, 1996), which supports the idea of point-of-use treatment. Because of the TI waiver, the cleanup goals apply only at the wellhead and not throughout the aquifer.

#### 4.1.2 Selected Remedy for Operable Unit 2

The selected remedy (HLA, 1996d) provides protection of human health and the environment by reducing potential risks associated with domestic use of the contaminated groundwater. The remedy includes the following components:

- Continue treatment for contaminants of concern (COCs) present in extracted groundwater at the Schofield Barracks Supply Wells and at the Del Monte Fresh Produce, Inc. (Del Monte) water supply system at Kunia Village (Well 3-2803-05) by air stripping at the wellhead followed by discharge of the treated water to the distribution system.
- The Army must consult with EPA and the State of Hawaii DOH prior to abandoning the Schofield Barracks water supply wells, because production at these wells may help to control plume migration.
- Implement long-term sampling and analysis of water supply wells, agricultural wells, and monitoring wells in the region. The monitoring well network for the long-term monitoring program is shown in Table 4.1.
- Implement the contingency of wellhead treatment on any water supply wells that are impacted by the plume from Schofield Barracks at concentrations above one-half of the MCL as established under the Safe Drinking Water Act (SDWA). The evaluation process for implementing treatment is illustrated in Figure 4.1.
- Upgrade the treatment system or pay any incremental costs for treatment caused by contamination from Schofield Barracks at wells that already have a treatment system in place.
- Conduct five-year site reviews with the Hawaii DOH and the EPA to ensure that human health and the environment continue to be protected.

In addition, Hawaii DOH requires that any new wells installed as water-supply wells under SDWA be sampled for the SDWA-specified analytes, which include TCE and CCl<sub>4</sub>. New water-supply wells that are installed within the area covered by the long-term monitoring network will be added to the existing long-term monitoring network (Table 4.1). Should these new wells be or become contaminated with COCs at the trigger concentrations described in Figure 4.1, and the contamination be shown to be directly attributed to Schofield Barracks, the selected wellhead treatment alternative would be implemented to address this contamination. The purpose of the groundwater monitoring portion of the selected remedy is to assess groundwater conditions and to track the movement of the TCE and CCl<sub>4</sub> plumes to provide an early warning of potential contamination and to assess whether wellhead treatment is warranted (see Figure 4.1).

The State Water Code, Chapter 174C HRS, Section 174C-82, states powers and duties of the Commission on Water Resource Management. These powers and duties included requiring that all wells are registered, requiring permits for well construction and pumps and pumping equipment, and requiring well completion reports. Section 174C-83 states that any person owning or operating any well shall register the well with the commission. For new wells, no well construction and no installation of pumps and pumping equipment shall commence without an appropriate permit from the commission. During five-year reviews, DLNR will be contacted to see if permits for any new wells have been issued since the previous five-year review.

All public water supply wells are sampled for a broad suite of analytical parameters on a regular basis, and results are reported to the Safe Drinking Water Branch. The contaminants of concern for Schofield Barracks OU 2, TCE and CCl<sub>4</sub>, are included in the analytical suite. Examples of public water supply wells are the Schofield Barracks shaft supply wells and the Wahiawa and Mililani municipal wells, all of which are also sampled as part of the OU 2 long-term monitoring program. Although owners of private wells are not required to test the water from their wells, private well owners are warned by the commission that water from their wells should not be considered safe to drink unless it is tested first. Suggested parameters for testing are listed in a handout downloadable from the DOH website. The parameters include organics, and owners are referred to an EPA website for the complete list of suggested parameters. Private well owners such as Del Monte conduct their own ongoing monitoring programs.

The details of the long-term groundwater monitoring plan, evaluation process for implementation of wellhead treatment, and description of conditions at existing water wells are presented in the OU 2 Operation and Maintenance Plan (HLA, 1996e).

#### 4.1.3 Operable Unit 2 Remedy Implementation

The OU 2 selected remedy was implemented immediately following the OU 2 ROD (HLA, 1996d) approval. Wellhead treatment via air stripping continued at the Schofield Barracks WTP and at the Del Monte Well 3-2803-05. Additionally, after approval of the OU 2 ROD, the Army reimbursed Del Monte for the capital cost of the air stripping tower and began reimbursing Del Monte for costs associated with operating the air stripper that treats groundwater from Well 3-2803-05 and provides a drinking water supply for Kunia Village. No additional wells have required treatment since that time. An interim long-term monitoring program was conducted from September 1996 through January 1997. The long-term monitoring program for OU 2 was implemented in April 1997 and continues to the present (2007).

#### 4.1.4 Operable Unit 2 System Operations and Maintenance

The OU 2 remedy components that are currently being implemented are long-term groundwater monitoring, wellhead treatment of groundwater at the Schofield Barracks WTP, and wellhead treatment at Del Monte Well 3-2803-05. The components of the OU 2 remedy that incur O&M costs are the following:

- Long-term groundwater monitoring program implementation
- Schofield Barracks groundwater treatment system operation
- Del Monte air stripper system O&M

O&M activities are described below and associated costs for each of these activities are summarized in Table 4.2.

##### 4.1.4.1 Long-term Groundwater Monitoring Program

The long-term monitoring program incorporates a network of wells (Table 4.1) that includes onpost monitoring wells, the Schofield Barracks water supply wells, and offpost domestic/municipal and irrigation wells. These wells were initially sampled either quarterly or semiannually, as specified in the

OU 2 O&M Plan (HLA, 1996e). Based on continuing evaluations of contaminant concentrations in these wells using the evaluation method shown in Figure 4.2, the monitoring frequency for some wells was reduced in May 2002 and again in December 2005. The initial monitoring frequency and changes implemented in May 2002 and December 2005 are shown in Table 4.3. Currently, five wells are sampled quarterly, six semiannually, and 21 annually. The current monitoring frequency for each well is presented in the right column of Table 4.3 (based on December 2005 proposal). Groundwater samples are analyzed for TCE and CCl<sub>4</sub>, and monitoring reports presenting the results are prepared quarterly.

As part of the monitoring program, the eleven onpost monitoring wells require routine maintenance, which has included pump and wiring repair or replacement for most of the wells. Total yearly costs for fiscal years 2002 through 2006 for the long-term groundwater monitoring program are presented in Table 4.2.

#### 4.1.4.2 Schofield Barracks Water Treatment Plant Operation and Maintenance

The Schofield Barracks WTP is designed to remove TCE and PCE from groundwater by air stripping treatment before distribution of the groundwater to the public. The Schofield Barracks WTP consists primarily of five packed air stripping towers (one remains on standby), four extraction wells (one remains on standby), a chlorination system, a fluorination system, process pumps, groundwater extraction pumps, process controls and instrumentation, piping and associated appurtenances. A complete description of the overall treatment plant equipment and its subsystems with respect to design parameters, operations, and maintenance are provided in Appendix A.

O&M is performed by Schofield Barracks personnel and primarily consists of replacement of bag filters every two weeks, wash down of one packed air stripper tower weekly, replacement of flow meters and flow sensors, as needed, one operator checking the plant operation daily, and quarterly influent and effluent WTP water sampling. The associated annual O&M costs for the WTP incurred for fiscal years 2002 through 2006 are presented in Table 4.2.

#### 4.1.4.3 Del Monte Air Stripper Treatment System Operation and Maintenance

The Del Monte Air Stripper Treatment System (ASTS) is designed to remove TCE and CCl<sub>4</sub> from groundwater extracted from Well 3-2803-05 by air stripping treatment before distribution of the groundwater to the Kunia Village water supply. The Del Monte ASTS consists primarily of one air stripping tower, one extraction well, one process pump, one groundwater extraction pump, process control and instrumentation, piping and associated appurtenances.

O&M is performed by Del Monte and associated costs are reimbursed by the Army. The costs reimbursed to date are those for air stripper tower installation, blower replacement, and routine O&M.

The reimbursed total cost provided to Del Monte by Schofield Barracks is presented in Table 4.2.

The ongoing O&M activities being performed are in accordance with the OU 2 O&M Plan (HLA, 1996e) and are successfully meeting the requirements stated in the OU 2 ROD.

#### 4.2 Operable Unit 4 Remedial Actions

This section presents a summary of RAOs and remedy selection and implementation for OU 4.

##### 4.2.1 Operable Unit 4 Remedial Action Objectives

The following RAOs were selected from EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites guidance document (EPA, 1993) to provide protection to human health and the environment for the media of concern identified in the OU 4 ROD (HLA, 1996c), which include landfill contents and landfill gas.

- Prevent direct contact with landfill contents.
- Reduce contaminant transport to groundwater.
- Control surface-water runoff and erosion.
- Control landfill gas.

#### 4.2.2 Selected Remedy for Operable Unit 4

The selected remedy provides protection of human health and the environment by reducing potential risks associated with direct contact of the landfill contents and potential transport of contaminants to groundwater. The remedy includes the following major components:

- Regrade the existing landfill cover to generally match the 1983 engineered drainage grade.
- Remove the existing Guinea grass and revegetate with another type of grass that is more appropriate for a landfill cover.
- Perform long-term maintenance of the landfill cover.
- Maintain existing landfill gas venting.
- Install additional gas monitoring points at the perimeter of the landfill.
- Implement institutional controls (landfill gas and groundwater monitoring, five-year site review, land-use restrictions, and site security).

#### 4.2.3 Operable Unit 4 Remedy Implementation

Implementation of the selected remedy began on March 10, 1997 and occurred in several different construction phases. The final inspection was performed on July 21, 1998. Landscaping activities were completed on August 7, 1998. Remedial activities consisted of the following:

- Clearing and grubbing of existing vegetation and selected trees and shrubbery
- Repairing landfill cracks
- Filling of landfill subsidence areas
- Regrading the surface of the landfill cover to maintain a positive slope to promote surface water runoff
- Landscaping with new vegetation
- Repairing a portion of the existing central drainage system
- Repairing eroded areas on the sides of the existing central drainage system
- Installing a cement rubble masonry (CRM) channel

- Installing nine new gas monitoring wells and modifying five existing monitoring wells

Upon completion of remedial activities, EPA determined that the landfill cap, drainage and monitoring systems were complete, functional, and operational.

#### 4.2.4 Operable Unit 4 System Operations and Maintenance

O&M of the landfill includes maintenance of the cover and long-term monitoring of perimeter landfill gas wells. The purpose of maintenance of the landfill cover is to ensure continued performance of the remedial action. O&M of the landfill cover was conducted in general accordance with the OU 4 O&M Plan (HLA, 1996f). O&M requirements include general inspection requirements, general maintenance requirements, long-term monitoring, recordkeeping, and reporting.

General inspection requirements include quarterly inspections of the landfill cover, vegetative cover, side slopes, drainage system, existing landfill gas wells, perimeter landfill gas monitoring system, groundwater monitoring well network, security fence, access roads, and survey monuments. The OU 4 O&M Plan (HLA, 1996f) also requires additional inspections of the landfill cover, side slopes, and drainage system after heavy rainfall events and after major storm or earthquake events.

Following are general maintenance requirements for the different components of OU 4:

- **Vegetative Cover:** Conducting perimeter control and spot control to prevent reinvasion of Guinea grass and other undesirable vegetative species and annual mowing of the vegetative cover.
- **Side Slopes:** Backfilling with topsoil and compacting damaged areas to the final grade. Placing erosion matting in areas where erosion or slumping is persistent until vegetation is adequately established.
- **Drainage System:** Repairing any structures found to be damaged, clogged, or incapable of conveying runoff flows.

Any damaged perimeter landfill gas monitoring wells, existing landfill gas wells, and groundwater monitoring wells are required to be repaired or replaced accordingly. In addition, any damaged security fences, access roads, and survey monuments are required to be repaired immediately.

Long-term monitoring for OU 4 consists of monitoring of the perimeter landfill gas wells. Hawaii State regulations require that landfill gas not exceed the lower explosive limit (LEL) at the landfill boundary. Therefore, quarterly landfill gas monitoring is required to evaluate gas concentrations. Landfill gas monitoring results are to be submitted to EPA and the Hawaii DOH, and these agencies require immediate notification if the LEL for methane gas is exceeded.

O&M costs for the OU 4 remedy include landfill gas monitoring, landfill landscaping (re-grading, application of herbicide to remove Guinea grass, etc.), landfill cover crack repair (from settlement and desiccation), and repair/replacement of any other damaged component listed above. The annual O&M costs incurred during fiscal years 2002 through 2006 for landfill cap maintenance and landfill gas monitoring are presented in Table 4.4. As shown in Table 4.4, the most significant cost is due to landfill O&M, which primarily consists of cover crack repair. The cost of landfill landscaping has also been substantial due to revegetation of the regraded area. Because landfill gas monitoring is performed as routine maintenance, the associated cost has been relatively consistent. The ongoing OU 4 O&M activities being performed by Schofield Barracks are in accordance with the OU 4 O&M Plan (HLA, 1996f) and are successfully meeting the requirements stated in the OU 4 ROD.



## 5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

The first five-year review for Schofield Barracks covered the period from March 1997 through September 2001. This second five-year review covers the period from October 2001 through December 2006.

Therefore, this review covers progress since the last five-year review period (i.e., since September 2001).

Progress for OU 2 and OU 4 are discussed separately in the following subsections.

### 5.1 Progress for Operable Unit 2

The following subsections provide discussions of the protectiveness statements from the first five-year review, the status of recommendations and follow-up actions made in the first five-year review, and the results of implemented actions.

#### 5.1.1 Protectiveness Statements from First Five-Year Review

The first five-year review stated that the remedy for OU 2 was functioning as intended by the OU 2 ROD and that the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection were still valid. One issue was identified that could impact the protectiveness of the remedy; TCE concentrations exceeded the action level of 2.5 µg/l in groundwater samples from Well 3-2803-01. Although this well was classified as a domestic/municipal use well, it was reported by DPW that the well was only used as a source for process water for the Kunia Tunnel cooling towers. Because Del Monte's water was available to the U.S. Department of the Navy (Navy) in case of an emergency, there would never be a time when this well would be used for domestic purposes. Therefore, the remedy was deemed to be effective and protective. Recent information has come to light that this well was misidentified and is actually Well 3-2803-03 according to Department of Land and Natural Resources (DLNR) records. This well is classified as industrial by DLNR. Therefore, the TCE concentrations in this well do not affect the protectiveness of the remedy and treatment is not necessary. The re-classification of use recommended in the First Five-year Review is no longer necessary.

5.1.2 Status of Recommendations and Follow-up Actions from First Five-Year Review

The recommendations for OU 2 from the first Five-Year Review Report (Harding ESE, 2002) and follow-up actions for each are discussed in this section.

*Repair or replace the protective surface housings for ten of the 11 on-post monitoring wells*

The repairs to the ten wells were completed in May 2002 by Beylik Drilling and Pump Services, Inc., under contract to Harding ESE.

*Change the use classification of Del Monte Well 3-2803-01 to ensure the groundwater from the well is not used as a domestic water source*

A letter was submitted by DPW to the Hawaii DLNR in 2002 requesting that the classification be changed to industrial in the State's records, and a use restriction was filed with the Navy to prevent changes to the well that would allow it to be connected to the drinking water system at the Kunia Tunnel without first treating the water to drinking water standards. The classification change was never implemented. Recent information from DLNR indicates that this well has been misidentified. In DLNR records, the designation 3-2803-01 corresponds to an abandoned pilot boring, and the well being sampled is actually Well 3-2303-03. Because this well is already classified as industrial, there is no need to change the classification.

*Decrease the frequency of the long-term groundwater monitoring by one-half for wells in which concentrations are stable or are decreasing in concentration. For other wells, retain the current frequency for two years and re-evaluate. Decrease the sampling frequency of Schofield Barracks Supply Wells 1, 2, and 3 from quarterly to annual. These recommended changes are summarized in Tables 9.1 and 9.2 of the first Five-Year Review Report (Harding ESE, 2002).*

A request to decrease the monitoring frequency for the wells recommended in the first Five-Year Review Report (Harding ESE, 2002) was submitted in a letter to EPA from DPW, dated November 4, 2002 (U.S. Dept of the Army DPW, 2002). These changes were approved and implemented as of the October-November 2002 sampling event. The sampling frequency of the monitoring network wells was

reevaluated two years later (i.e., in 2004), and recommendations to reduce the monitoring frequency for an additional five wells were made in the March 2005 Groundwater Monitoring Report for OUs 2 and 4 (Versar, 2005). EPA and the Hawaii DOH concurred with these changes in letters dated August 24, 2005 and December 15, 2005, respectively. In conjunction with their concurrence, the Hawaii DOH requested an addendum to the Final OU 2 O&M Plan (HLA, 1996e) to officially request these changes in monitoring frequency. The addendum was submitted to DPW on April 10, 2006 and was approved by EPA in a letter to DPW dated July 17, 2006 (EPA, 2006). The changes in monitoring frequency were implemented as of the December 2005 monitoring event. A summary of the changes in the monitoring frequency of wells in the long-term monitoring program is provided in Table 4.3.

#### 5.1.3 Results of Implemented Actions

The results of the implemented actions are as follows:

##### *Well Repairs*

The onpost monitoring wells have been maintained in good condition after repairs were completed.

##### *Classification Change of Del Monte Well 3-2803-01*

As described in Section 5.1.2, the classification change to industrial was not approved by DOH.

However, recently obtained information indicates this well is actually Well 3-2803-03, which is already classified as industrial. Therefore, no further action is required regarding this well.

##### *Changes in Groundwater Sampling Frequency*

The monitoring frequency for 23 wells was changed to either semi-annual or annual in October 2002 based on data indicating there were no changes in concentration or there were decreases in concentration during the first five-year review period. The monitoring frequency was reevaluated after two years and was decreased to annual for an additional five wells in December 2005. Currently, 21 wells are sampled annually, six wells are sampled semi-annually, and five wells are sampled quarterly, as shown in the rightmost column of Table 4.3.

## 5.2 Progress for Operable Unit 4

The following subsections provide discussions of the protectiveness statements from the first Five-Year Review Report, the status of recommendations and follow-up actions made in the first five-year review, and the results of implemented actions.

### 5.2.1 Protectiveness Statements from First Five-Year Review

The first Five-Year Review Report (Harding ESE, 2002) stated that the OU 4 remedy was functioning as intended and would continue to improve groundwater conditions provided that continued maintenance and repair are performed on the landfill cover. The existing institutional controls were effective in prohibiting the use or disturbance of groundwater, excavation activities, disturbance of the cover, or other activities that might interfere with the implemented remedy. In addition, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy implementation were valid. Finally, no additional information was available that could call into question the protectiveness of the remedy. Based on the available data, the remedy was considered to be effective and protective with continued maintenance and repair.

### 5.2.2 Status of Recommendations and Follow-up Actions from First Five Year Review and Results

This section presents a discussion of the recommendations for OU 4 made in the first Five-Year Review Report (Harding ESE, 2002) and follow-up actions taken to implement these recommendations.

#### *Repair Cracks in the Cover Due to Settlement and Desiccation*

Repair of the cracks in the landfill cover was completed in October 2002 by a private construction contractor. The repairs were effective in preventing surface water from infiltrating into the waste layer. However, on-going repair of cracks noted in subsequent inspections are necessary to maintain the remedy.

*Slight to Moderate Erosion Evident in the Center Drainage Channel of the Landfill*

Increased rainfall after the last five-year review resulted in an increase in the landfill vegetative cover, including the channel. As such, it was not necessary to revegetate this area or install permanent erosion matting. Ongoing minor erosion is noted on the walls of the channel, however, and surface debris is periodically cleared from the channel to help minimize the erosion and allow for natural revegetation. Ongoing inspections have noted that the silt fences are intact.

*Repair or Replace Corroded Protective Surface Housings at Four Landfill Monitoring Wells*

The protective casings were repaired by Beylik Drilling and Pump Services, Inc., under contract to Harding ESE, in April 2002.



## 6.0 FIVE-YEAR REVIEW PROCESS AND FINDINGS

The five-year review process consists of several components, including document and data review and evaluation, site inspections, and community involvement activities. This section presents discussions of each of these process components and the findings of the review. EPA Region 9 was notified about the initiation of the second five-year review in January 2007. The Army's five-year review team included Mr. Joel Narusawa of the Schofield Barracks DPW and Mr. Guy Romine, a contractor supporting the U.S. Army Environmental Command. Mr. Mark Ripperda is the team member from EPA and Mr. Ukris Wongse-Ont is the team member from DOH.

Components of the five-year review process include the following:

- Historical and Recent Document Review and Findings
- Data Review and Evaluation
- Remedy Inspections and Findings
- Community Relations

The following subsections describe the document and data review and evaluation, relevant inspections, findings for OUs 2 and 4, and the public involvement components for both OUs.

### 6.1 Operable Unit 2 Document and Data Review and Findings

Historical documents relevant to the Schofield Barracks CERCLA process and documents produced and data collected for OU 2 over the past five years were reviewed as a part of this five-year review process. A list of these documents is presented in Appendix B, and discussions of the review and findings are presented in the following subsections.

#### 6.1.1 Operable Unit 2 Historical Document Review

Documents relevant to the CERCLA process, including the ROD (HLA, 1996d), the Comprehensive Five-Year Review Guidance (EPA, 2001), and the OU 2 O&M Plan (HLA, 1996e) were reviewed as part

of this five-year review. The following subsections present discussions of the review of each of these documents in the context of remedy compliance.

#### 6.1.1.1 Operable Unit 2 Record of Decision

The OU 2 ROD (HLA, 1996d) documents the selected remedy, summarizes the rationale for remedy selection, identifies ARARs, and documents other aspects of the decision. The document was reviewed to ensure that the remedy remains in compliance with the ROD and to assess whether any ARARs presented in the ROD have been revised, replaced, or deleted in the past five years. The ARARs tables presented in the OU 2 ROD (Tables 2.2 and 2.3) have been revised and are presented in Appendix C.

A summary of OU 2 ARARs changes is as follows:

- Location-Specific ARARs
  - Several ARAR citations have been corrected from Hawaii Administrative Rules (HAR) to Hawaii Revised Statutes (HRS).
  - 50 CFR 227, which relates to threatened or endangered habitat, was deleted from the CFR as of October 1, 1999.
- Action-Specific ARARs
  - HAR 11-60.1-68, related to air stripper emissions, was modified but is still applicable.

The updated location-, chemical-, and action-specific ARARs are listed below. The text is shown in italic type where ARARs have been revised from those stated in the ROD:

- Location-specific ARARs:
  - 16 United States Code (USC) 661 et seq., 662 and 663, requiring actions to be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources.
  - *Clean Water Act (CWA) 404, 33 CFR 320-330, and 40 CFR 230, prohibiting discharges that cause or contribute to significant degradation of the water of ecosystems.*
  - HAR 183D-61 et seq., prohibiting interference with wild birds or their nests.

- CWA 404, prohibiting the discharge of fill material into aquatic ecosystems that would jeopardize endangered, threatened, or rare species.
- *HAR 194D-4, 16 USC 1531 et seq., 50 CFR 402 prohibiting actions that jeopardize endangered or threatened species or critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226. 50 CFR 227 was deleted on October 1, 1999.*
- Chemical-specific ARARs
  - *40 CFR Part 141.2, defining SDWA MCLs and maximum contaminant level goals (MCLGs).*
  - *40 CFR 141.50, listing MCLGs for organic contaminants.*
  - *40 CFR 141.61, listing MCLs for organic contaminants.*
  - *EPA, Office of Water, Drinking Water Standards and Health Advisories, EPA 822-B-00-001, Summer 2000.*
- Action-specific ARARs:
  - HAR 11-60.1-33(a)(1)-(7) and (b), prohibiting the discharge of visible fugitive dust emissions beyond the property lot line on which the dust originates and requiring precautions to prevent fugitive dust emissions.
  - *HAR 11-60.1-68, requiring monitoring of VOC emissions if emissions are greater than 0.1 ton per year for each hazardous air pollutant.*
  - 40 CFR Part 141, Subparts B and G, defining MCLs.

#### 6.1.1.2 Five-Year Review Guidance Document

The Five-Year Review Guidance document (EPA, 2001) was reviewed to ensure that the review process and reporting are in compliance with this document.

#### 6.1.1.3 Operation and Maintenance and Long-Term Groundwater Monitoring Plan

The OU 2 O&M Plan (HLA, 1996e) documents the long-term monitoring program, sampling and analysis procedures, contingencies for revising the program, O&M requirements, and reporting requirements.

This document was reviewed to ensure that each of these items are being conducted in compliance with the plan. Important items discussed in the O&M plan are the monitoring well network, sampling frequencies, and contingencies for applying wellhead treatment. Wells in the monitoring well network

are summarized in Table 4.1 and their locations are shown in Figure 3.3. The procedural diagrams for changing monitoring frequency for a well, or for applying wellhead treatment based on changing COC concentrations, are presented in Figures 4.1 and 4.2. Review of the O&M Plan indicated that the monitoring program is being conducted in compliance with the plan.

Three minor revisions are proposed to the OU 2 O&M Plan (Section 2.1.4.2) (HLA, 1996) and OU 4 O&M Plan (Section 6.1.2.4) (HLA, 1996). These revisions relate to sample handling and shipping and are the result of changes in sampling guidance by EPA since the O&M Plans were prepared. First, updated guidance (EPA, 2004) states that water samples collected for volatiles analysis should be filled to capacity with no air bubbles, preserved to a pH of 2 with HCl, and cooled to 4 °C (plus or minus 2 °C) immediately after sample collection. Second, samples must be shipped as soon as possible, preferably on the same day as sample collection to avoid exceeding sample holding times. If overnight transit is not possible, samples should be maintained at 2 to 4 °C until they are shipped to the laboratory (EPA, 2004). Third, samples that are preserved with HCl must be analyzed within 14 days of sample collection. Water samples that have not been maintained at a temperature of 4 °C (plus or minus 2 °C) and preserved to a pH of 2 or below should be analyzed within 7 days from sample collection (EPA, 1999). Given that the water samples are for monitoring purposes only, water samples that are received by the laboratory at a temperature exceeding 4 °C will be noted as having an elevated temperature.

6.1.2        Operable Unit 2 Recent Document Review, Data Evaluation, and Findings

OU 2 documents reviewed for the past five years include quarterly groundwater monitoring reports, regulatory correspondence, and fact sheets. The following subsections present discussions of the review of each of these reports and documents, and the resulting findings.

#### 6.1.2.1 Review of Quarterly Groundwater Monitoring Reports and Analytical Data Evaluation

Groundwater monitoring was performed for a subset of wells each quarterly, semiannual, or annual sampling event, in general accordance with the O&M Plans (HLA, 1996e,f) and Addenda to the Plans (Versar, 2006). The current monitoring well network and the monitoring frequency for each well are shown in the rightmost column of Table 4.3. The groundwater sampling events performed during the five-year review period are shown in Table 6.1. Groundwater monitoring reports were prepared for each of these events and submitted to the Army, HDOH, and EPA. Those reports were reviewed for this report. In addition to a review of the groundwater monitoring reports, the data were also evaluated to assess trends in concentrations over the past five years. The results of the report review and data evaluation are presented in this subsection.

Based on a review of the groundwater monitoring reports, deviations from the O&M Plans (HLA, 1996e, f) included the omission of two quarters of monitoring in 2006 and not sampling wells in the network during past monitoring events. Monitoring was not conducted during the first and third quarters of 2006 because of contractual issues. Table 6.2 summarizes the wells designated for sampling, but not sampled during the five-year review period. For most of these wells, the pumps were non-functional and required repair. There were also several wells that were stated to be not available for sampling, but no explanation is given. [In the Harding ESE reports, this statement meant that a well could only be sampled if the well owner was also scheduled to sample it, and sometimes the owner did not sample the well.] Access to several wells was not granted in December 2006, and access was blocked to two of the wells. In addition, Well 2803-07, which is scheduled to be sampled semi-annually, was only sampled annually between 2004 and 2006.

Well 3-2803-01 was misidentified in March, June, and August of 2005 and, therefore, not sampled. This well was correctly identified and sampled in December 2005 and in the subsequent annual event (November 2006). As described in Section 5.1.2, this well is actually Well 3-2803-03 in the DLNR records.

Letters from the Hawaii DOH with review comments on the August 2005 and Annual 2005 groundwater monitoring reports (DOH, 2006 and 2007), requested that the Army develop a contingency plan for sampling all wells specified in the OU 2 and OU 4 O&M Plans (HLA, 1996e, f). This plan is presented in Section 9.1.2.

Time versus concentration plots were developed for each well based on data collected between 1993 and December 2006. These graphs, presented in Appendix D, were used to evaluate trends in concentration for each well in the groundwater monitoring network. The graphs are also shown in map view in Figures 3.3 and 3.4. Table 6.3 presents the detailed TCE and CCl<sub>4</sub> trend analyses for each of these wells. Based on the monitoring reports and the trend evaluation, the distribution of contaminants in groundwater has changed very little over the past five years. Some wells have shown slightly increasing trends in TCE or CCl<sub>4</sub>, or both. Other wells have exhibited slightly decreasing trends. The following is a summary of conclusions regarding the analytical data from the quarterly reports reviewed and the trend analyses and evaluation:

- CCl<sub>4</sub> was undetected or below the MCL in all OU 2 wells.
- TCE concentrations in seven OU 2 wells (2901-02, 2901-03, 2901-04, 2901-10, 2900-02, 2801-02, and 2902-03) were above the MCL during the last five years of sampling. Concentrations ranged from 5 to 63.2 µg/l in these wells.
- The highest TCE concentration (63.2 µg/l) was detected in OU 2 water supply well 2901-10 (Schofield Shaft Well #4). This well is sampled before entering the ASTS where water is treated to below the MCL prior to distribution.

- CCl<sub>4</sub> concentrations in OU 4 wells have been below the MCL since 2002. OU 4 well 3004-01 has shown an increasing trend since August 2004.
- TCE concentrations in three OU 4 wells (3004-01, 3004-04, and 3004-05) were above the MCL during the last five years of sampling, ranging from 19 to 28.7 µg/l. All three wells exhibit slightly increasing trends since August 2004.
- Based on the review of monitoring data, recommendations for changes in monitoring frequency for three onpost monitoring wells and one offsite supply wells are included in Section 9.1.2 and Table 9.2.

#### 6.1.2.2 Regulatory Correspondence

Correspondence from the EPA and the Hawaii DOH for the time period 2001 to 2006 include comments based on reviews of Groundwater Monitoring reports and Addenda to the O&M Plan (Versar, 2006). The following were of note in correspondence from these regulatory agencies.

- A letter from EPA dated August 24, 2005 (EPA, 2005) indicates EPA concurrence with the recommendations made in the First Quarter 2005 Groundwater Monitoring Report to reduce the sampling frequency for Wells MW1-1, MW2-5, MW2-6, and MW4-1 from semiannually to annually and Well 2803-01 (recently identified as 2803-03) from quarterly to annual.
- Hawaii DOH concurred with the recommendations to reduce sampling frequency in a letter dated December 15, 2005 (DOH, 2005) and requested the submittal of addenda to the O&M Plans (Harding ESE, 1996e). These addenda were submitted on April 10, 2006.
- Hawaii DOH had several comments based on review of the Final Annual Groundwater Monitoring Report for 2005 (submitted April 7, 2006). In a letter dated June 29, 2006 (DOH, 2006) DOH states that Well 2901-10 should not be used as a drinking water source since the highest TCE concentration in this well was 63.2 µg/l. However, the high TCE concentration is from a point sampled previous to air stripping. Groundwater samples collected from a point after air stripping and prior to entering the treatment system, are below the MCL of 5 µg/l before distribution. Therefore, the post-air stripping TCE concentration is not considered a risk to human health.
- In the June 29, 2006 letter (DOH, 2006), Hawaii DOH specified that the Army should initiate a contingency plan to sample all wells specified in the O&M plan. The plan should address how the Army will respond to offline wells or wells with out-of-service pumps in order to collect groundwater samples. This plan should be included in the next five-year review. A contingency plan has been developed in this report, and is presented in Section 9.1.2.
- In the June 29, 2006 letter (DOH, 2006), Hawaii DOH also stated that the rationale for reverting back to the semi-annual sampling frequency for Well MW 4-1 (3004-01) should be an upward trend with a trigger level of 30 µg/l. The Army is currently using this concentration as the trigger for increasing sampling frequency in this well.
- A letter from EPA to DPW (EPA, 2006), dated July 17, 2006, approves reducing the sampling frequency of Wells 3-2803-01, 3-2901-13, 3-2959-01, 3-2802-01, and 3004-01 and concurs with

the Hawaii DOH recommendation for re-evaluating the sampling frequency of Well 3004-01 using a criteria of 30 µg/l.

#### 6.1.2.3 Fact Sheet Regarding Groundwater Modeling

A fact sheet was issued by the U.S. Army Corp of Engineers in November 2006 (USACE, 2006) documenting a reevaluation of the groundwater modeling performed for the OU 2 RI as part of the IRP at Schofield. The re-evaluation, performed in 2006, evaluated the potential impacts on the TCE groundwater plume due to changes in groundwater pumping in the Schofield Barracks area due to agricultural retreat. The results showed that groundwater pumping from 1995 to 2005 has generally decreased and that total pumping in the vicinity of Schofield is small compared to the total recharge. Therefore, changes in pumping over this 10-year period are unlikely to impact the TCE plume size or movement. The fact sheet is included in Appendix E.

### 6.2 Operable Unit 2 Remedy Inspections

Inspections of the OU 2 on-post groundwater monitoring wells, the Schofield Barracks WTP, and the Del Monte air stripper were conducted in February and March 2007. These inspections are described in this subsection, and an inspection checklist for the onpost monitoring wells is presented in Appendix F.

#### 6.2.1 Onpost Groundwater Monitoring Wells

Onpost inspections of the Schofield Barracks onpost groundwater monitoring wells were conducted during February 2007. Items that were inspected included pump motor and visible wiring, water level sounding tubes, surface well casings, concrete pads, and protective housings around the surface casings. The findings of the inspections included an inoperable pump motors in Monitoring Well MW 2-1 (3-2900-02). Besides this one pump, the eleven wells were found to be in good condition. The pump in MW 2-1 was removed for diagnosis on March 26, 2007, and repairs were completed on May 3, 2007. A bollard at MW 2-1 that was knocked down is scheduled to be repaired during the August 2007 monitoring round.

#### 6.2.2 Schofield Barracks Water Treatment Plant

A site visit to the Schofield Barracks WTP was made on March 15, 2007. The system description for the Schofield Barracks WTP is found in Appendix A. Samples are reportedly collected from the influent and effluent by both the Hawaii DOH and the Army, and TCE concentrations must consistently be below the analytical detection limit of 0.5 µg/l. Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed.

#### 6.2.3 Del Monte Air Stripper Treatment System

A site visit to the Del Monte WTP at Kunia village was made on March 15, 2007. Samples are reportedly collected from the influent and effluent by the Hawaii Department of Health, and analytical results indicate TCE and CCl<sub>4</sub> concentrations have consistently been below the analytical detection limit of 0.5 µg/l. Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed.

#### 6.2.4 Recommendations for Optimization

Based on the OU 2 reviews discussed in Section 6.2, several follow-up actions or changes to monitoring frequency are recommended. These recommendations are summarized in Section 9.1.

### 6.3 Operable Unit 4 Document and Data Review and Findings

One historical document relevant to the Schofield Barracks CERCLA process and other documents produced and data collected for OU 4 over the past five years were reviewed as a part of this five-year review process. This information included the OU 4 ROD, quarterly landfill inspections reports, and landfill gas monitoring reports. A list of these documents is included in Appendix B, and discussions of the review and findings are presented in the following subsections.

#### 6.3.1 Operable Unit 4 Historical Document Review

The only historical document reviewed for OU 4 was the OU 4 ROD (HLA, 1996c). The OU 4 ROD (HLA 1996c) presented a response action for OU 4, summarizes the rationale for remedy selection, identifies ARARs, and documents other aspects of the decision. The document was reviewed to ensure that the remedy remains in compliance with the ROD and to assess any revisions to the ARARs presented in the ROD over the past five years. The ARARs presented in the ROD (Tables 2.3 and 2.4) have been updated and are presented in Appendix C.

A summary of ARARs changes is as follows:

- Action-Specific ARARs
  - Several ARAR citations have been corrected from HAR to HRS.
  - Requirements under Long-term Groundwater Monitoring and Maintenance of the Landfill Cover have been revised to state that a period less than the postclosure care period is sufficient to show protectiveness of human health and the environment if this demonstration is approved by the director HAR S11-58.1-17(b)(2)(a).
- Location-Specific ARARs
  - Several ARAR citations have been corrected from HC to HRS.

The updated ARARs are presented below:

- Action-specific ARARs:
  - Fugitive dust emission limitations contained in HAR 11-60.1-33(a)(1-7)(b).
  - HAR 11-55-34.02(b)(2), Appendix C, and HAR 11-55-34.04(b), Appendix A, requiring substantive compliance with storm-water discharge parameters (including monitoring storm-water discharge) associated with construction activity. An active NPDES permit is not required as it is an administrative requirement and not an ARAR.
  - HAR 11-58.1-16, requirements for groundwater monitoring during the postclosure care period at the Municipal Solid Waste Landfill (MSWLF) units.

- HAR 11-58.1-17(a)(9)(A, B), which requires a notation be placed on the landfill property following closure of the MSWLF to indicate the land was used as a landfill. The property deed will be modified if ownership of the affected parcel is transferred.
- HRS Title 28, Chapter 508C – Uniform Environmental Covenants Act, which allows an environmental covenant describing any activity or use limitations on the property to be added to the deed (if necessary) if the property is transferred..
- HAR 11-58.1-17(b) requiring postclosure care of the landfill for 30 years.
- HAR 11-59-4(f) and (h) limiting the concentration of ozone in ambient air to 100 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) in one hour.
- HAR 11-60.1-68 requiring monitoring and measurement of VOC emissions if emissions are greater than 1 ton per year for each air pollutant.
- Chemical-specific ARARs
  - None.
- Location-specific ARARs
  - None.

### 6.3.2 Recent Document Review and Findings

OU 4 documents reviewed for the past five years include quarterly landfill gas monitoring reports and landfill inspection reports. The following subsections present discussions of the review of these reports and the resulting findings.

#### 6.3.2.1 Quarterly Landfill Gas Monitoring Reports

Quarterly landfill gas monitoring was conducted in accordance with the selected remedy described in the OU 4 ROD. Landfill gas monitoring was performed at the former Landfill to assess whether methane concentrations at the perimeter of the landfill exceeded the LEL. Such concentrations would be in violation of the HAR 11-58-1.17, identified as an ARAR for OU 4 (Appendix C). Each quarterly landfill gas monitoring report includes a table of results, a gas probe location map, and a gas probe installation diagram. The table of results includes the probe depth, atmospheric pressure, barometric pressure in the probe, methane concentration, oxygen concentration, and carbon dioxide concentration. Time versus

concentration plots of data collected as part of the long-term landfill gas monitoring program are presented in Appendix G.

Methane concentrations over the past five years were zero, except in May 2002, when the percent by volume ranged from 0.10 to 0.20 and the percent of the LEL ranged from 2 to 4 in gas probes 1 through 8. At no time was the LEL exceeded during the quarterly landfill gas monitoring. Barometric pressure readings in the probes were usually equal to the atmospheric pressure readings. Therefore, methane concentrations in the atmosphere will not exceed the LEL.

Based on the past five years of landfill gas monitoring data, as well as the previous five years of landfill gas monitoring data presented in the First Five-year Review (Harding ESE, 2002), it is apparent that methane gas concentrations at the landfill perimeter are not an issue. The landfill is now old enough (over 25 years since last waste placement) that the methane gas production rate should be on the decline. Therefore, continued landfill gas monitoring is unnecessary and could be eliminated with no loss in protectiveness.

#### 6.3.2.2 Quarterly Landfill Inspection Reports

Other information that is relevant for the five-year review is contained in the quarterly landfill inspection reports, because they document performance of the OU 4 remedy on a regular basis. Landfill inspection reports from December 2001 to October 2006 were reviewed for this report (see Appendix H). As summarized in Table 6.4, the most serious problem observed in the performance of the remedy over the past five years was cracking of the landfill cover due to settlement and desiccation. Cracks noted in 2001 and 2002 were repaired in October 2002. However, cracks were noted in subsequent inspection reports through 2006. These reports indicate that repair of these cracks is still pending.

A secondary issue related to performance of the OU 4 remedy has been the maintenance of the vegetative cover. Extensive growth of Guinea grass and other invasive plants was noted in the inspection report for March 18, 2005. In addition, barren areas were noted in several areas throughout the landfill from August 2005 through October 2006, and several small trees have been observed growing on the cap since June 2006. The growth of Guinea grass was managed with herbicides and revegetation of Rye grass, and barren areas were seeded with Rye grass. The vegetation is maintained when necessary on an ongoing basis as part of the landfill operations and maintenance program. As of the last inspection report (October, 2006), there was extensive growth of Guinea grass and other weeds in previously cleared side slopes and cap.

Several areas in the northwest sector of the landfill had undergone erosion and required filling with soil to bring them back to original grade, and areas with stabilization rock required topsoil cover. These repairs were made between September and November, 2005. Erosion was also noted in the central drainage channel. Because all structures in the channel were intact, no specific maintenance activities were performed, except clearing the channel of debris during each inspection.

A Technical Memorandum for Record was submitted by Joel Narusawa, the IRP Program Manager, on January 25, 2006 which indicated that there has been some concern regarding erosion along the side slopes of the landfill. This memo was prepared in response to Versar's verbal request of January 12, 2006 and other verbal requests from Versar regarding side slope maintenance at the landfill. The response memo states that the Army would prefer to see a phased removal of the trees and shrubs that are present in localized areas on the side slopes. They recommend that the trees and shrubs be cut low to the ground or slightly below grade, where possible. This activity should be combined with preventive erosion control measures, such as matting, which would prevent further damage to the side slopes beyond what has already occurred. This activity will be included in the recommendations in Section 9.0.

### 6.3.3 Operable Unit 4 Remedy Inspection

The OU 4 remedy inspection was conducted at the Former Landfill on March 1, 2007. The purpose of the onpost inspection was to assess the effectiveness and protectiveness of the remedy. The inspection included an assessment of the security fence, signs, institutional controls, access roads, general site conditions, landfill surface, vegetative surface, drainage system, and landfill cover penetrations (landfill gas wells, groundwater monitoring wells, etc.). An inspection checklist was filled out during the onpost inspection to assist in proper and complete documentation (see Appendix F).

Currently, the most significant maintenance issues noted during the inspection are the following:

- Small amounts of erosion in areas of the Center Drainage Channel and Northern Drainage Channel,
- Erosion along portions of the perimeter fence,
- Isolated barren areas in the cover system,
- Guinea grass and other invasive weeds in channels, runoff control berms, and side slopes.

The landfill inspection reports are presented in Appendix H, and photographs illustrating the conditions noted above are presented in Appendix I.

The following are additional observations made during the five-year review site inspection:

- Access and institutional controls are currently in good condition, except for erosion along portions of the fence.
- Roads are adequate.
- There is no vandalism evident.
- There is no evidence of slope instability.
- Monitoring wells are properly secured, functioning, and routinely sampled.

#### 6.3.4 Recommendations for Optimization

Based on the OU 4 reviews discussed in Section 6.3, several follow-up actions or changes to monitoring frequency are recommended. These recommendations are summarized in Section 9.2.

#### 6.4 Community Relations for Operable Unit 2 and Operable Unit 4

Community relations for OUs 2 and 4 over the past five years included the distribution of an information sheet for the project and a fact sheet regarding groundwater modeling. An information sheet was distributed by the DPW in July 2006 (US Army DPW, 2006) providing a general description of the project and a project summary. A fact sheet was distributed by the U.S. Army Corps of Engineers in November 2006 (USACE, 2006) describing the reevaluation of the groundwater modeling performed as part of the IRP Program, as described in detail in Section 6.1.2.3. Both the information sheet and the fact sheet regarding groundwater modeling are included in Appendix E.

Public notice of the Schofield Barracks five-year review is being conducted through both a posted fact sheet and a community mailing, in accordance with the Schofield Barracks Community Relations Plan (HLA, 1997). In compliance with Appendix A of the Comprehensive Five-Year Review Guidance (EPA, 2001) these public notice documents include:

- The site name and location
- The lead agency conducting the review
- A brief description of the selected remedy
- A summary of contamination addressed by the selected remedy
- A brief summary of the results of the five-year review
- The protectiveness statements
- A brief summary of data and information that provided the basis for determining protectiveness, issues, recommendations, and follow-up actions directly related to the protectiveness of the remedy

- How the community can contribute (public comment period)
- Locations where a copy of the five-year review report can be obtained or viewed
- A contact point and phone number for further information
- Dates of both the completion of the review and the next five-year review

In addition to the public notice documents, there will also be a public comment period to allow involvement by members of the community.

## 7.0 TECHNICAL ASSESSMENT

In accordance with the Comprehensive Five-Year Review Guidance, three questions are presented and answered for each OU in the following subsections to evaluate and assess the effectiveness and protectiveness of the remedy.

### 7.1 Operable Unit 2 Remedy Evaluation

This subsection presents answers to the three remedy and protectiveness evaluation questions for OU 2.

#### 7.1.1 Evaluation of the Remedy for Operable Unit 2

***Question A: Is the remedy functioning as intended by the decision documents?***

Based on the information gathered during the five-year review process, the remedy is functioning as intended by the OU 2 ROD (HLA, 1996d) and OU 2 O&M Plan (HLA, 1996e). The Schofield Barracks Supply Wells and Del Monte Well 3-2803-05 have operating wellhead treatment systems that incorporate air stripping to remove TCE and CCl<sub>4</sub> from groundwater and both systems are regularly maintained. The long-term groundwater monitoring program is being implemented as described in the OU 2 ROD and OU 2 O&M Plan (HLA, 1996e). However, the groundwater remediation goals, which are MCLs for TCE and CCl<sub>4</sub>, have not yet been achieved in subsurface groundwater. Because extracted groundwater does not meet MCLs, treatment, monitoring, and five-year reviews will continue until extracted groundwater does meet MCLs for TCE and CCl<sub>4</sub>. Wellhead treatment is necessary as long as produced water is above MCLs, but the water within the aquifer does not need to achieve MCLs because of the TI waiver (EPA, 1996)(see Section 4.1.1).

#### 7.1.2 Evaluation of Previous Assumptions for Operable Unit 2

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?***

No changes to the exposure assumptions, toxicity data, cleanup levels or RAOs were found during the review process.

7.1.3 Evaluation of Effectiveness/Protectiveness of Operable Unit 2

**Question C:** *Has any other information come to light that could call into question the protectiveness of the remedy?*

No additional information has come to light over the last five years that would call into question the protectiveness of the OU 2 remedy.

7.2 Operable Unit 4 Remedy Evaluation

This subsection presents answers to the three remedy and protectiveness evaluation questions for OU 4.

7.2.1 Evaluation of the Remedy for Operable Unit 4

**Question A:** *Is the remedy functioning as intended by the decision documents?*

Review of the ARARs, risk assumptions, quarterly data, landfill inspection reports, and the five-year review site inspection indicate that the OU 4 remedy will continue to improve groundwater conditions and function as intended provided that continued maintenance and repair are performed on the landfill cover. The operations and maintenance required to maintain the integrity and functionality of the landfill cover include continued routine inspections, periodic repair of the cracks, landscaping maintenance, regrading due to settlement, and revegetation of regraded areas. Continued landfill gas monitoring is currently required to ensure that methane concentrations do not exceed the LEL; however landfill gas monitoring is being recommended for elimination because of the very low or undetected methane concentrations measured during the past five years.

Cracks have been noted in the landfill cover in inspection reports for the past five years (Table 6.4). The reports indicate that the last time cracks were repaired was in October 2002, and that further repairs are currently pending. Trend plots for OU 4 wells indicate a slight increase in TCE and CCl<sub>4</sub> concentrations since August 2004, which may possibly be related to the presence of cracks in the cover. These cracks require ongoing repair to ensure that the remedy is effective in preventing the infiltration of surface water

and the migration of contaminants through the landfill to groundwater. At the date of the landfill inspection for this five-year review, the landfill cracks appeared to be under control.

The average annual O&M cost over the last five years was approximately \$160,000. This cost includes landfill gas monitoring, landfill landscaping, and crack repair. It is likely that at least this amount, and possibly more, would be required on an annual basis to maintain the integrity and functionality of the existing remedy. Additional future costs may include repair and maintenance of the drainage system and maintenance of the side slopes.

The existing institutional controls include prohibitions on the use or disturbance of groundwater, prohibitions on excavation activities, disturbance of the landfill cover, and any other activities that might interfere with the implemented remedy. No vandalism or other activities were observed that would have violated these institutional controls. The fence around the site is intact and in good condition, with the exception of erosion near some fence posts that needs to be restored.

The objective when implementing land use controls is to develop a system of mutually reinforcing controls to ensure that land use is consistent with restrictions placed on the property during the environmental restoration process (DoD, 2001a). The institutional controls specified in the OU 4 ROD (HLA, 1996c) are groundwater monitoring, five-year site review, land use restrictions, and site security. The OU 4 O&M Plan (HLA, 1996f) documents procedures for implementing those controls through long-term groundwater and landfill gas monitoring and physical inspections of the landfill and the security fence. As mandated in DoD policy (DoD, 2001a) and guidance (DoD, 2001b), landfill land use controls are stored in a land use control layer in the installation GIS database.

The four OU 4 monitoring wells MW-4-1 to MW-4-4 are registered with DLNR Commission on Water Resource Management for environmental monitoring use. As described in Section 4.1.2, a change in well

use would require a request to the Commission on Water Resource Management to do so. Any new wells installed in the vicinity of the landfill would also require permits, and because of the institutional controls in the base environmental records, a request for the use of groundwater for water supply would not be approved without provisions for water treatment.

If the landfill property were being considered for transfer to another party, a Finding of Suitability for Transfer (FOST) would need to be prepared (DoD, 2001a). The FOST would need to include discussion of the institutional controls for the landfill. However, no such transfer is being considered. At the time DoD property is transferred from federal ownership, DoD or the transferee will execute a restrictive covenant regarding land use controls then in effect for environmental restoration sites in a form acceptable to DOH and consistent with DoD policy (DoD, 2001a).

#### 7.2.2 Evaluation of Previous Assumptions for Operable Unit 4

***Question B:*** *Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?*

Exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy implementation are still valid.

#### *Changes in Standards and To Be Considered*

During construction and since completion of the remedial action, the action-specific ARARs cited in the OU 4 ROD (HLA, 1996c) have been met. However, some of the ARARs included in the ROD do not apply to current activity at the Former Landfill. These ARARs include substantive compliance with NPDES requirements, fugitive dust emission limitations, placement of a notation on the landfill property indicating it was used as a landfill, and monitoring and measurement of VOC emissions if emissions are greater than 1 ton per year for each pollutant. Additional construction activity or changes in site conditions may have an effect on the applicability of the ARARs (i.e., additional construction activity would require substantive compliance with storm-water discharge parameters and compliance to fugitive

dust emission limitations); however, all of the ARARs are currently being met. Minor changes in ARARs and To Be Considered (TBCs) have occurred, as presented Appendix C. None of these changes affect the protectiveness of the remedy.

*Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics*

Since implementation of the remedy, there have been no changes in land use, no new contaminants or contaminant sources, no changes in toxicity and other contaminant characteristics, no remedy byproducts, and no changes in exposure pathways. Therefore, the risk assessment should not be any different than when the remedy was first implemented. The media of interest for the OU 4 baseline risk assessment (see Appendix I of the FS) were surface soil, surface water, and sediment. Exposure to these media has not been affected by the cracks or the lack of vegetation on the landfill cover.

7.2.3 Evaluation of Effectiveness/Protectiveness of Operable Unit 4

***Question C: Has any other information come to light that could call into question the protectiveness of the remedy?***

According to the landfill site inspection reports and the landfill gas monitoring data, the remedy is functioning as intended by the OU 4 ROD with continued maintenance and repair. The OU 4 ARARs cited in the OU 4 ROD have been met. There have been no changes in land use, no new contaminants or contaminant sources, no changes in toxicity and other contaminant characteristics, no remedy byproducts, and no changes in exposure pathways.

No ecological targets were identified in the baseline risk assessment and none were identified during the five-year review. Therefore, monitoring of ecological targets is not necessary. No weather related events have affected the protectiveness of the remedy other than what was previously identified (lack of rainfall).

Based on these unchanged conditions, the risk assessment does not require reevaluation. There is no other information that calls into question the protectiveness of the remedy.

### 7.3 Summary of Technical Assessment

Based on the review of documents, reports, and data for OU 2 and OU 4 for the past five years, the remedies are functioning as intended by their respective RODs. However, continued maintenance and repair of the landfill cover is required to maintain the protectiveness of the OU 4 remedy. In addition, there were no changes in RAOs, and the risk assessments do not require any reevaluation. There is no additional information available that would call into question the protectiveness of the remedies.

## 8.0 ISSUES REGARDING REMEDIAL MEASURES

Issues or items that need to be addressed or resolved to maintain the effectiveness and protectiveness of the remedies are discussed in this section. Issues for OU 2 and OU 4 are presented separately below and are summarized in Table 8.1.

### 8.1 Issues Regarding Operable Unit 2

Issues regarding the continued effectiveness and protectiveness of the OU 2 remedy are the following:

- The dedicated submersible pump in Monitoring Well MW 2-1 (3-2900-02) was inoperative when the well was inspected in February 2007. Plans to diagnose and repair the pump have been made.
- The concentrations and distribution of TCE and CCl<sub>4</sub> contamination in the Schofield High-Level Aquifer have changed very little in the past five years. Trends in concentrations indicate slight, gradual changes or no change for most wells. The relative stability of the concentrations over time suggests that lower monitoring frequencies for some wells may be sufficient to assure protectiveness of the remedy.
- The TCE concentration in Well 3-2901-13 increased to greater than 2.5 µg/l for one sampling event. This location is an onpost monitoring well and, as such, the increase does not pose a risk. Increasing the monitoring frequency may be considered if concentrations remain above 2.5 µg/l in the next sampling event.
- Well 3-2803-01 was incorrectly identified during three monitoring events in 2005 and was not sampled.
- Well 3-2803-01 has been incorrectly identified. The well being sampled is actually Well 3-2803-03.
- Several wells were not sampled during the 5-year review period due to inoperable pumps or access problems. DOH requested that a contingency plan be developed for sampling all wells in the long-term monitoring network as part of this five-year review. This plan is presented in Section 9.0.

### 8.2 Issues Regarding Operable Unit 4

Issues regarding the continued effectiveness and protectiveness of the OU 4 remedy are as follows:

- Cracking of the cover in many areas of the landfill due to settlement and desiccation
- Minor erosion and some cracking of the cement in the cement rubble masonry are evident in the Center Drainage Channel of the landfill.

- Several new small trees growing on the cap; these do not include the 20-25 year old, large tree in the northern area of the landfill.
- Extensive growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap
- Several isolated barren areas throughout the landfill
- Areas of erosion under the north and east fence and two areas where trees are entangled in the fence
- Slight erosion around the concrete footings of numerous fence posts, and there is one slightly damaged post.
- The protective surface housings for the four landfill gas monitoring wells are slightly deteriorating.

In addition to the listed maintenance activities, it is recommended that quarterly landfill gas monitoring be eliminated. The methane concentrations in the gas probes were measured to be greater than zero in only one monitoring event in the past five years, and the methane concentrations in that one event were far less than the 5 percent methane concentration limit. Based on the data reviewed, continuing the landfill gas monitoring is unnecessary and discontinuing the monitoring would not affect protectiveness.

## 9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issues have been identified for each OU during this five-year review that must be addressed for the respective remedies to continue to be protective of human health and the environment. In addition, the analytical data for each well have been evaluated to assess whether changes in monitoring frequency are warranted. This section presents recommendations and follow-up actions for addressing the remedy issues and the recommendations for changes in monitoring frequency.

### 9.1 Recommendations and Follow-up Actions for Operable Unit 2

Issues regarding the effectiveness and protectiveness of the OU 2 remedy, as implemented, are identified in Section 8.1. Measures to address these issues include the following:

- The pump in Monitoring Well MW 2-1 (3-2900-02) was repaired on May 3, 2007. These repairs restored the well to service for sample collection.
- Monitor the TCE concentrations in Well 3-3004-01 to assess increasing the monitoring frequency if the concentration reaches 30 µg/l.
- Correct the name of Well 3-2803-01 to 3-2803-03 in future sampling events and in the database.
- Developed a contingency plan for sampling all wells in the long-term groundwater monitoring program. The plan is presented in the following subsection.

#### 9.1.1 Groundwater Sampling Contingency Plan

Two approaches are recommended as contingencies for ensuring that data are collected at the locations and intervals specified in the OU 2 and OU 4 O&M Plans (Harding ESE, 1996e,f). First, a substitute well has been assigned to each monitoring well, where possible. This approach has been used at Schofield in the past; Well 2800-01 has been sampled in lieu of Well 2800-03, and Well 2859-02 has been sampled in lieu of Well 2859-01. If a substitute well is not available, the issue should be resolved as soon as possible so that the network well can be sampled in the subsequent quarterly sampling event. Wells in the long-term monitoring network were evaluated to assess whether an adjacent well with a similar producing interval was available that could function as a substitute. In some cases, the substitute well is already

sampled (i.e., is in the network), but will provide the data necessary to assess contaminant concentrations in the same zone and same location. Alternative wells to be sampled in lieu of sampling the designated network well are summarized in Table 9.1. Several of the network wells have no nearby well that could be used as a substitute. For non-Army owned offpost wells, sampling the alternate wells is the only feasible option. If the pump is non-functional in onpost monitoring wells, a contractor should be employed to repair the pump as soon as possible after identification of the problem. If access is the issue, arrangements should be made to sample the well at an alternative time that would be acceptable to the owner. One exception is Well No. 3-3103-01. Efforts are currently in progress by the Army to obtain estimates for repairing this well, so that regular sampling can be resumed.

During this five-year review, DLNR was contacted and it was learned that no new wells had been installed within the TCE plume area since the first five-year review. In future five-year reviews, DLNR should be contacted to see if permits for any new wells have been issued since the previous five-year review.

#### 9.1.2 Changes in Monitoring Frequency

The analytical data for each well were analyzed to assess whether the current monitoring frequency can be reduced and still be protective of health and the environment, using the process described in Section 4.1.4. Based on this evaluation it is recommended that the monitoring frequency for four wells in the long-term groundwater monitoring be decreased, as described below and summarized in Table 9.2.

The concentration of TCE in Wells 2801-02 and 2900-02 are greater than 5 µg/l. However, these are both monitoring wells located within the plume, and the concentrations have remained relatively stable or decreased over the past 10 years. The concentration of CCl<sub>4</sub> in these wells is below 1 µg/l and stable. Therefore, it is recommended that the monitoring frequency for these wells be reduced from quarterly to annual.

Well 2902-03 is an onpost monitoring well located within the plume. The TCE concentration in this well shows a very slight decreasing trend over the past 10 years (i.e., from 9.5 to 5 µg/l), and the CCl<sub>4</sub> concentration is below 2.5 µg/l. Therefore, it is recommended that the monitoring frequency for this well be reduced from quarterly to annual.

Well 2803-07 is an offpost irrigation/municipal water supply well. The TCE and CCl<sub>4</sub> concentrations in this well have been below 1 µg/l for the past 10 years and are stable. Therefore, it is recommended that the monitoring frequency for this well be reduced from semiannual to annual.

Recommendations and follow-up actions presented in Section 9.1 are summarized in Tables 9.1 and 9.2.

## 9.2 Recommendations and Follow-up Actions for Operable Unit 4

Issues regarding the effectiveness and protectiveness of the OU 4 remedy, as implemented, are identified in Section 8.2. Routine maintenance and repair of remedy components must be continued in order to achieve maximum performance of the OU 4 remedy. Measures to address these issues are the following:

- Repair the cracks in the landfill cover when they are observed.
- Take measures to address the slight erosion and cracked concrete evident in the Center Drainage Channel of the landfill. The cracked concrete should be repaired, and recommendations for addressing the erosion include one of the following: (1) regrading/revegetating, (2) installment of permanent erosion matting, or (3) placement of riprap along affected areas.
- Repair any corroded protective surface housings for the four groundwater monitoring wells at the landfill.
- Remove new small trees growing on the cap. Note that this does not include the large, 20-25 year old tree near the northwest perimeter of the landfill. A decision was made, with the concurrence of the Army, to leave the large tree.
- Manage growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap with herbicides, followed by revegetation with native grasses or using procedures that are in accordance with the O&M plan.
- Fill in eroded areas under fence with soil or rock and remove trees entangled in the fence.

- Fill in eroded areas around the concrete footings of fence posts, and replace or repair damaged post.

Recommendations and follow-up actions presented in Section 9.2 are summarized in Table 9.3.

In addition to the listed maintenance activities, it is recommended that quarterly landfill gas monitoring be discontinued. The methane concentrations in the gas probes were measured to be greater than zero in only one monitoring event in the past five years, and the methane concentrations in that one event were far less than the 5 percent methane concentration limit. Based on the data reviewed, the landfill gas monitoring is unnecessary.

## 10.0 PROTECTIVENESS STATEMENTS

Based on the findings of the second five-year review, the remedies for OU 2 and OU 4 have been evaluated and recommendations and follow-up actions have been identified. Based on the implementation of these measures, protectiveness statements are made below for each OU.

### 10.1 Effectiveness of Current Measures for Operable Unit 2

The primary RAO for the OU 2 implemented remedy was to protect human health and the environment by limiting contact with groundwater exceeding the MCLs. Human health is protected by using air strippers to treat groundwater from supply wells with concentrations above the MCLs (the four Schofield Barracks Supply Wells and Del Monte Well 3-2803-05). The treatment systems are fully operational and functional and treat groundwater to remove contaminants to levels an order of magnitude below MCLs. Results from the monitoring well network show that the plume is not migrating downgradient. The Army will continue to maintain and operate the treatment systems and the monitoring well network until TCE and CCl<sub>4</sub> MCLs are achieved in groundwater, and will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. Therefore, the remedy continues to be effective and protective.

### 10.2 Effectiveness of Current Measures for Operable Unit 4

The primary RAO of the implemented remedy was to protect human health and the environment by limiting direct contact with the Former Landfill contents and by restricting surface-water infiltration through the landfill. Construction and implementation of the landfill cover met the first half of the RAO by limiting direct contact with the Former Landfill contents. Continued repair and maintenance of the OU 4 remedy will continue to comply with the second half of the RAO by restricting surface-water infiltration through the landfill. Therefore, the remedy continues to be effective and protective.



## 11.0 NEXT REVIEW

The next review for Schofield Barracks OU 2 Groundwater and OU 4 Former Landfill is scheduled to begin in five years, by March 2012, and be finalized by September 30, 2012.



## 12.0 ACRONYMS AND ABBREVIATIONS

µg/l	Micrograms per liter
ARARs	Applicable or Relevant and Appropriate Requirements
Army	U.S. Department of the Army
ASTS	Air Stripper Treatment System
bgs	Below ground surface
CCl <sub>4</sub>	Carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CRM	Cement Rubble Masonry
CWA	Clean Water Act
DLNR	Department of Land and Natural Resources
DOH	Department of Health
DPW	U.S. Army Garrison, Hawaii Directorate of Public Works
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FFA	Federal Facility Agreement
HAR	Hawaii Administrative Rules
Harding ESE	Harding ESE, Inc.
HC	Hawaii Code
HLA	Harding Lawson Associates
HRS	Hawaii Revised Statutes
IRP	Installation Restoration Program
LEL	Lower Explosive Limit

MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
mm	Millimeter
MSWLF	Municipal Solid Waste Landfill
Navy	U.S. Department of the Navy
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OE	Ordnance explosives
OU	Operable Unit
PA	Preliminary Assessment
PCE	Tetrachloroethene
ppb	Parts per billion
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
Schofield Barracks	Schofield Army Barracks, Island of Oahu, Hawaii
SDWA	Safe Drinking Water Act
SI	Site Investigation
TBC	To Be Considered
TAMC	Tripler Army Medical Center
TCE	Trichloroethene
USAEC	United States Army Environmental Command
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USC	United States Code

VOC	Volatile Organic Compound
WTP	Water treatment plant



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Table 4.1: Long-Term Groundwater Monitoring Well Network  
Second Five-Year Review Period  
Schofield Army Barracks

Site Identification	Well Name	Operable Unit and Well Type
26003GWPK	3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply
26031GWPW	3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply
27025GWPW	3-2702-05	OU 2 Offsite Monitoring Well
270302GW/DELMONTENU	3-2703-02 (Del Monte)	OU 2 Offsite Irrigation Well
28003GWPK	3-2800-03	OU 2 Offsite Domestic/Municipal Water Supply
OU2-4GWSH	3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well
OU2-6GWSH	3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well
28031GWSH*	3-2803-01 (3-2803-03)*	OU 2 Offsite Industrial Well
28035GWSH	3-2803-05 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Well
28037GWSH	3-2803-07 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Well
28591GWPK	3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well
OU2-1GWSH	3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well
SCHMWGWSH	3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well
SCH1GWSH	3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well
SCH2GWSH	3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well
SCH3GWSH	3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well
SCH4GWSH	3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well
290111GWSH	3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply
290112GWSH	3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply
OU1-1GWSH	3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well
29021GWSH	3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply
OU2-3GWSH	3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well
OU2-2GWSH	3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well
OU2-5GWSH	3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well
OU4-1GWSH	3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well
OU4-3GWSH	3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well
OU4-4GWSH	3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well
OU4-2AGWSH	3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well
31002GWSH	3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply
31022GWSH	3-3102-02	OU 2 Offsite Irrigation Well
31031GW	3-3103-01	OU 4 Offsite Irrigation Well
32032GWSH	3-3203-02	OU 2 Offsite Irrigation Well

OU - Operable Unit

\* Hawaii Department of Land and Natural Resources records list 3-2803-03 as the well that is being sampled.

Table 4.2: Operation and Maintenance Cost for Operable Unit 2  
Fiscal Years 2002 through 2006  
Second Five-Year Review Period  
Schofield Army Barracks

ACTIVITY	2002	2003	2004	2005	2006	TOTAL
Long-term Groundwater Monitoring and Reporting	\$217,000.00	\$230,000.00	\$205,000.00	\$180,000.00	\$90,000.00	\$922,000.00
Schofield Barracks WTP Air Stripper O&M&M*	\$19,000.00	\$21,000.00	\$22,000.00	\$25,000.00	\$30,000.00	\$117,000.00
Del Monte Air Stripper Treatment System O&M	\$24,000.00	\$25,000.00	\$26,000.00	\$30,000.00	\$30,000.00	\$135,000.00
<b>TOTAL</b>	<b>\$260,000.00</b>	<b>\$276,000.00</b>	<b>\$253,000.00</b>	<b>\$235,000.00</b>	<b>\$150,000.00</b>	<b>\$1,174,000.00</b>

\* - Includes routine operation and maintenance and quarterly operations monitoring

O&M - Operation and Maintenance

O&M&M - Operation and Maintenance and Monitoring

WTP - Water Treatment Plant

Table 4.3: Changes in Monitoring Frequency  
Long-Term Groundwater Monitoring Program for OU 2 and OU 4  
Second Five-Year Review Period  
Schofield Army Barracks

Well ID	Original Monitoring Frequency	October 2002 Change in Monitoring Frequency	December 2005 Change in Monitoring Frequency and Current frequency
3-2600-03	Semiannual	Annual	Annual
3-2603-01	Semiannual	Annual	Annual
3-2702-05	Semiannual	Annual	Annual
3-2703-02 (Del Monte Basal)	Semiannual	Annual	Annual
3-2800-03/2800-01*	Semiannual	Annual	Annual
3-2801-02 (MW-2-4)	Quarterly	Quarterly	Quarterly
3-2802-01 (MW-2-6)	Quarterly	Semiannual	Annual
3-2803-01	Quarterly	Quarterly	Annual
3-2803-05 (Del Monte #3)	Quarterly	Quarterly	Quarterly
3-2803-07 (Del Monte #4)	Quarterly	Semiannual	Semiannual
3-2859-01/2859-02*	Semiannual	Annual	Annual
3-2900-02 (MW-2-1)	Quarterly	Quarterly	Quarterly
3-2901-01 (Shaft Monitoring Well)	Quarterly	Annual	Annual
3-2901-02 (Supply Well 1)	Quarterly	Semiannual	Semiannual
3-2901-03 (Supply Well 2)	Quarterly	Semiannual	Semiannual
3-2901-04 (Supply Well 3)	Quarterly	Semiannual	Semiannual
3-2901-10 (Supply Well 4)	Quarterly	Quarterly	Quarterly
3-2901-11	Semiannual	Annual	Annual
3-2901-12	Semiannual	Annual	Annual
3-2901-13 (MW-1-1)	Quarterly	Semiannual	Annual
3-2902-01	Semiannual	Annual	Annual
3-2902-03 (MW-2-3)	Quarterly	Quarterly	Quarterly
3-2903-01 (MW-2-2)	Semiannual	Annual	Annual
3-2959-01 (MW-2-5)	Quarterly	Semiannual	Annual
3-3004-01 (MW-4-1)	Semiannual	Semiannual	Annual
3-3004-03 (MW-4-3)	Semiannual	Semiannual	Semiannual
3-3004-04 (MW-4-4)	Semiannual	Semiannual	Semiannual
3-3004-05 (MW-4-2A)	Semiannual	Annual	Annual
3-3100-02	Semiannual	Annual	Annual
3-3102-02	Semiannual	Annual	Annual
3-3103-01	Semiannual	Annual	Annual
3-3203-02	Semiannual	Annual	Annual

\* - Wells sampled in lieu of designated well when pump was non-functional or offline

OU - Operable units

Table 4.4: Operation and Maintenance Cost for Operable Unit 4  
Fiscal Years 2002 through 2006  
Second Five-Year Review Period  
Schofield Army Barracks

ACTIVITY	2002	2003	2004	2005	2006	TOTAL
Landfill O&M	\$35,000	\$35,000	\$500,000	\$200,000	\$20,000	\$790,000
Landfill Groundwater Monitoring	\$38,000	\$41,000	\$36,000	*	\$30,000	\$145,000
Landfill Gas Monitoring	\$18,000	\$21,000	\$16,000	*	\$5,000	\$60,000
Quarterly Groundwater Monitoring Reporting	#	#	#	\$40,000	\$30,000	\$70,000
<b>Totals</b>	\$91,000	\$97,000.00	\$552,000.00	\$240,000.00	\$85,000.00	\$1,065,000

\* - Operation and maintenance and monitoring for groundwater and landfill gas were not separated into different tasks

# - The cost for reporting was included with the monitoring cost.

O&M - Operation and Maintenance

OU - Operable Unit

Table 6.1: Summary of Groundwater Sampling Events Performed  
During Second Five-year Review Period  
Schofield Army Barracks

Sampling Round	Sampling Date	Event
24	November - December 2001	Semiannual Sampling
25	February - March 2002	Quarterly Sampling
26	April - May 2002	Annual Sampling
27	August 2002	Quarterly Sampling
28	October - November 2002	Semiannual Sampling
29	February 2003	Quarterly Sampling
30	April - July 2003	Annual Sampling
31	August 2003	Quarterly Sampling
32	March - April 2004	Semiannual Sampling
33	May 2004	Quarterly Sampling
34	August - September 2004	Annual Sampling
35	November 2004	Quarterly Sampling
36	March 2005	Semiannual Sampling
37	June 2005	Quarterly Sampling
38	August 2005	Annual Sampling
39	December 2005	Quarterly Sampling
40	June - July 2006	Semiannual Sampling
41	November 2006	Annual Sampling

Table 6.2: Network Wells Not Sampled  
During Second Five-Year Review Period  
Schofield Army Barracks

	Round 24 (Semiannual)	Round 25 (Quarterly)	Round 26 (Annual)	Round 27 (Quarterly)	Round 28 (Semiannual)	Round 29 (Annual)	Round 30 (Quarterly)
Well ID	November/December 2001	February/March 2002	April/May 2002	August 2002	October/November 2002 *	February 2003 *	April/July 2003
2603-01			Non-functional pump <sup>1</sup>				
2702-05	Not available for sampling		Not available for sampling <sup>2</sup>	Not available for sampling			
2703-02			Not available for sampling <sup>1</sup>				Not available for sampling
2800-01	Not available for sampling		Not available for sampling				
2800-03	Not available for sampling		Non-functional pump <sup>1</sup>				
2802-01							
2803-01							
2803-05			Not available for sampling				
2803-07	Not available for sampling		Not available for sampling				
2859-01							
2900-02							
2901-02		Non-functional pump					Non-functional pump <sup>3</sup>
2901-03							
2901-11							
2901-12	Non-functional pump		Non-functional pump	Non-functional pump			Non-functional pump
2902-01							
2902-03							
2959-01							
3004-05							
3100-02							
3102-02			Not available for sampling <sup>1</sup>				
3103-01			Not available for sampling <sup>1</sup>				
3203-02			Not available for sampling <sup>1</sup>				Non-functional pump

Table 6.2: Network Wells Not Sampled  
During Second Five-Year Review Period  
Schofield Army Barracks

	Round 31 (Quarterly)	Round 32 (Semiannual)	Round 33 (Quarterly)	Round 34 (Annual)	Round 35 (Quarterly)	Round 36 (Semiannual)	Round 37 (Quarterly)
Well ID	August 2003 *	March/April 2004	May 2004	August/September 2004	November 2004 *	March 2005	June 2005
2603-01							
2702-05				Not available for sampling <sup>4</sup>			
2703-02				Not available for sampling			
2800-01							
2800-03							
2802-01							
2803-01				Not available for sampling		Misidentified	Misidentified
2803-05							
2803-07				Non-functional pump		Non-functional pump	
2859-01							
2900-02							
2901-02		Non-functional pump	Non-functional pump				
2901-03							
2901-11							
2901-12							
2902-01							
2902-03		Non-functional pump					
2959-01							
3004-05				Non-functional pump <sup>5</sup>			
3100-02							
3102-02							
3103-01				Not available for sampling			
3203-02							

Table 6.2: Network Wells Not Sampled  
During Second Five-Year Review Period  
Schofield Army Barracks

	Round 38 (Annual)	Round 39 (Quarterly)	Round 40 (Semiannual)	Round 41 (Annual)
Well ID	August 2005	December 2005 *	June/July 2006	November 2006
2603-01	Non-functional pump			Access not granted
2702-05	Non-functional pump			Access not granted
2703-02				Access not granted
2800-01				
2800-03				
2802-01				Access blocked
2803-01	Misidentified			
2803-05				
2803-07				
2859-01	Non-functional pump			Pump offline for maintenance
2900-02				Pump out of service
2901-02				
2901-03				Pump offline for maintenance
2901-11				Pump offline for maintenance
2901-12	Non-functional pump			Pump offline for maintenance
2902-01	Non-functional pump			
2902-03				
2959-01				Access blocked
3004-05				
3100-02				Access not granted
3102-02	Non-functional pump			Pump offline for maintenance
3103-01			Access not granted	Pump offline for maintenance
3203-02	Non-functional pump			

Note: The November 2003 Sampling Event could not be completed due to contractual issues

\* - All wells sampled during this round

1 - This well was sampled during Round 27 (August 2002)

2 - This well was sampled during Round 28 (October/November 2002)

3 - This well was sampled during Round 31 (August 2003)

4 - This well was sampled during Round 32 (March/April 2004)

5 - This well was sampled during Round 35 (November 2004)

Table 6.3: Long-Term Groundwater Monitoring Wells Trend Evaluation  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCL4 Trend Evaluation
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-2800-03/3-2800-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable
3-2859-01/3-2859-02	OU 2 Offsite Domestic/Municipal Water Supply Well	Stable, <1 ug/L. Not sampled in 2005 and 2006. Pump needs repair, otherwise should sample 3-2859-02	<1 ug/L, stable
3-2803-01	OU 2 Offsite Industrial Well	In the plume, < 5 ug/L, around 2.5 ug/L and decreasing trend	CCL4 concentrations increased above 1 ug/L in November 2005, <1 ug/L since
3-2703-02 (Del Monte Basal)	OU 2 Offsite Irrigation Well	Stable, <1 ug/L	<1 ug/L, stable
3-3102-02	OU 2 Offsite Irrigation Well	Stable, <1 ug/L	<1 ug/L, stable
3-3203-02	OU 2 Offsite Irrigation Well	Stable, <1 ug/L	<1 ug/L, stable
3-2803-05 (Del Monte #3)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume, < 5 ug/L, > 2.5 ug/L but stable	CCL4 concentrations increased above 1 ug/L in November 2005, <1 ug/L since
3-2803-07 (Del Monte #4)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	Stable, staying <1 ug/L	<1 ug/L, stable
3-2702-05	OU 2 Offsite Monitoring Well	Slight increasing trend but <2.5 ug/L	<1 ug/L, stable
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	In the plume, >10 ug/L, but stable	<1 ug/L, stable
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	In the plume, < 5 ug/L, around 2.5 ug/L but stable	<1 ug/L, stable
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	In the plume, >10 ug/L, but decreasing trend	<1 ug/L, stable
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	In the plume, < 5 ug/L, exceeded 2.5 ug/L in November 2006. Require two sampling results > 2.5 ug/L to increase frequency of sampling to semiannually.	<1 ug/L, stable

Table 6.3: Long-Term Groundwater Monitoring Wells Trend Evaluation  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCL4 Trend Evaluation
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	In the plume, stable around 5 ug/L with a slight decreasing trend	In the plume, stable, < 2.5 ug/L
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	In the plume, stable, <2.5 and <1 ug/L	<1 ug/L, stable
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	In the plume, stable, <2.5 and <1 ug/L	<1 ug/L, stable
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >10 ug/L, but stable	<1 ug/L, stable
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >5 ug/L, but stable	<1 ug/L, stable
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >10 ug/L, but stable	<1 ug/L, stable
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >10 ug/L, had an increase in TCE concentrations in August 2005	<1 ug/L, stable
3-3103-01	OU 4 Offsite Irrigation Well	Downgradient of landfill, stable, <1 ug/L	<1 ug/L, stable
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	Downgradient of landfill, stable, staying at or around 1 ug/L	<1 ug/L, stable
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	Landfill well. >5 ug/L. Decreasing trend until August 2004, upward trend since then. Evaluate in two years increasing the sampling frequency back to semiannual if TCE >30 ug/L.	Landfill well. <5 ug/L. Similar trend to TCE. Evaluate in two years increasing the sampling frequency back to semiannual if CCL4 >6 ug/L or TCE >30 ug/L.
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	Landfill well. >5 ug/L. Increasing trend, repair landfill cap then evaluate in next sampling following cap repair	Landfill well. <5 ug/L. Similar trend to TCE.
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	Landfill well. >5 ug/L. Staying between 20 to 30 ug/L, TCE concentrations increasing since August 2005. Evaluate after landfill cap repair.	Landfill well. <5 ug/L. Similar trend to TCE.
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	Landfill well. Increasing since 2003 but just <2.5 ug/L. Evaluate after landfill cap repair. Well was sampled semiannually by mistake in 2006, go back to annual sampling.	<1 ug/L, stable

µg/L - Micrograms per liter  
CCL4 - Carbon Tetrachloride

OU - Operable Unit  
TCE - Trichloroethene

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
I. Facility Access Control System						
A. Security Fence						
1. Gaps Beneath Fence						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	No deficiencies observed	
6/27/2002	X			X	No deficiencies observed	
11/20/2002	X			X	No deficiencies observed	
3/27/2003					No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005	X			X	No deficiencies observed	
8/26/2005		X	X		Repair gaps under fence with soil or rock or add more wire	9/05 - 11/05
12/14/2005	X			X	No deficiencies observed	
6/30/2006		X	X		Vegetation too thick in some areas along fenceline to see bottom of fence; gaps resulting in several areas on the N and E fence due to erosion wearing down the ground level	
10/4/2006		X	X		Vegetation too thick in some areas along fenceline to see bottom of fence; gaps resulting in several areas on the N and E fence due to erosion wearing down the ground level	
2. Chain-Link Fabric						
12/27/2001	X			X	Intact and fully functional	
3/28/2002	X			X	Intact and fully functional	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005		X	X		West fence requires repair. Area of approximately 6 ft <sup>2</sup> requires repair	May 05
8/26/2005	X			X		
12/14/2005	X			X		
6/30/2006		X	X		Two areas where trees are becoming entangled in the fence	
10/4/2006		X	X		Two areas where trees are becoming entangled in the fence	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
4. Fence Posts						
12/27/2001		X		X	Few fence posts damaged, but does not compromise integrity	
3/28/2002		X		X	Few fence posts damaged, but does not affect security	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Fence still intact-- no action required	
6/11/2003	X			X	Fence still intact-- no action required	
7/31/2003	X			X	Fence still intact-- no action required	
10/7/2003	X			X	Fence still intact-- no action required	
3/18/05 - 6/1/2005		X	X		12-14 posts, and 6-8 top rails require replacement or repair	May-05
8/26/2005	X		X		Fill in topsoil around footing base at eroded areas	9/05 - 11/05
12/14/2005	X			X		
6/30/2006		X	X		Small amount of erosion occurring around concrete footing of two fence posts	
10/4/2006		X	X		Small to moderate amount of erosion occurring around concrete footing of numerous fence posts. One slightly damaged post	
B. Site Access Gates						
1. Gate Locks						
12/27/2001	X			X	Intact and fully functional	
3/28/2002	X			X	Intact and fully functional	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005	X			X	Intact and fully functional	
8/26/2005	X			X	Intact and fully functional	
12/14/2005	X			X	Intact and fully functional	
6/30/2006	X			X	Intact and fully functional	
10/4/2006	X			X	Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
2. Gate Operation						
12/27/2001	X		X		Intact and fully functional	
3/28/2002	X		X		Intact and fully functional	
6/27/2002	X		X		Intact and fully functional	
11/20/2002	X		X		Intact and fully functional	
3/27/2003	X		X		Intact and fully functional	
6/11/2003	X		X		Intact and fully functional	
7/31/2003	X		X		Intact and fully functional	
10/7/2003	X		X		Intact and fully functional	
3/18/05 - 6/1/2005	X		X		Intact and fully functional	
8/26/2005	X		X		Intact and fully functional	
12/14/2005	X		X		Intact and fully functional	
6/30/2006	X		X		Intact and fully functional	
10/4/2006	X		X		Intact and fully functional	
C. Warning Signs						
12/27/2001	X		X		Intact and fully functional	
3/28/2002	X		X		Intact and fully functional	
6/27/2002	X		X		Intact and fully functional	
11/20/2002	X		X		Intact and fully functional	
3/27/2003	X		X		Intact and fully functional	
6/11/2003	X		X		Intact and fully functional	
7/31/2003	X		X		Intact and fully functional	
10/7/2003	X		X		Intact and fully functional	
3/18/05 - 6/1/2005	X		X		Intact and fully functional	
8/26/2005	X		X		Intact and fully functional	
12/14/2005	X		X		Intact and fully functional	
6/30/2006	X		X		Intact and fully functional	
10/4/2006	X		X		Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
D. Access Roads						
12/27/2001	X			X	Good shape with no potholes or obstructions preventing traffic	
3/28/2002	X			X	Good shape with no potholes or obstructions preventing traffic	
6/27/2002	X			X	Good shape with no potholes or obstructions preventing traffic	
11/20/2002	X			X	Good shape with no potholes or obstructions preventing traffic	
3/27/2003	X			X	Good shape with no potholes or obstructions preventing traffic	
6/11/2003	X			X	Good shape with no potholes or obstructions preventing traffic	
7/31/2003	X			X	Good shape with no potholes or obstructions preventing traffic	
10/7/2003	X			X	Good shape with no potholes or obstructions preventing traffic	
3/18/05 - 6/1/2005	X			X	Good shape with no potholes or obstructions preventing traffic	
8/26/2005	X			X	Good shape with no potholes or obstructions preventing traffic	
12/14/2005	X			X	Good shape with no potholes or obstructions preventing traffic	
6/30/2006	X			X	Good shape with no potholes or obstructions preventing traffic	
10/4/2006	X			X	Good shape with no potholes or obstructions preventing traffic	
2. Runon/Runoff Controls						
A. Northern Runoff Control Berms						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	NA				Area under repair	
6/27/2002	NA				Not accessible this quarter	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005	X			X	No deficiencies observed	
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	Vegetation dry and brown	
10/4/2006	X			X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
B. Center Drainage Channel						
12/27/2001		X	X		Erosion on sides of channel, no obstructions that would impede runoff flow	
3/28/2002		X	X		Area to be repaired under current action/All structures intact	
6/27/2002	X			X	No deficiencies observed	
11/20/2002	X			X	Signs of erosion, chute cleared of debris, all structures intact	
3/27/2003	X			X	Signs of erosion, chute cleared of debris, all structures intact	
6/11/2003	X			X	Signs of erosion, chute cleared of debris, all structures intact	
7/31/2003	X			X	Signs of erosion, chute cleared of debris, all structures intact	
10/7/2003	X			X	Signs of erosion, chute cleared of debris	
3/18/05 - 6/1/2005		X	X		Erosion control measures need to be improved. Previously placed fabric appears to have washed out	May 05
8/26/2005	X			X		
12/14/2005		X	X		Minor erosion occurring near rip-rap	December 05
6/30/2006		X	X		Concrete in rip-rap channel cracking	
10/4/2006		X	X		Concrete in rip-rap channel cracking	
C. Northern Drainage Channel						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	NA				Area under repair/all structures intact	
6/27/2002	NA				Not Accessible this quarter	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005	X			X	No deficiencies observed	
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	No deficiencies observed	
10/4/2006	X			X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
D. Western Drainage Channel						
12/27/2001		X	X		Cracks present in vicinity of swale	
3/28/2002		X	X		Area to be repaired under current action/all structures intact	
6/27/2002	NA				Not Accessible this quarter	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Debris and vegetation hanging over the fence need to be removed	May-05
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006		X	X		Erosion exposing gravel in channel	
10/4/2006		X	X		Erosion exposing gravel in channel	
E. North-central Side Slope Drainage Chute						
12/27/2001	X			X	No deficiencies observed	
3/28/2002					Area under repair	
6/27/2002	X			X	Not Accessible this quarter	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003				X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Stabilization of drainage chute is necessary to prevent further erosion	May-05
8/26/2005	X			X		
12/14/2005	X			X		
6/30/2006		X	X		Erosion visible in channel sides, overall channel is stable	
10/4/2006		X	X		Erosion visible in channel sides	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
F. Northern Side Slope Drainage Chute						
12/27/2001	X			X	No deficiencies observed	
3/28/2002					Area under repair	
6/27/2002	X			X	No deficiencies observed	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003				X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Vegetation hanging over the fence need to be removed	May-05
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	No deficiencies observed	
10/4/2006	X			X	No deficiencies observed	
G. Northwestern Side Slope Drainage Chute						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	NA				Area under repair	
6/27/2002	NA				Not Accessible this quarter	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Debris needs to be removed from fence. Eroded area requires stabilization	May-05
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	No deficiencies observed	
10/4/2006	X			X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
3. Final Cover System (Top and Side Slopes)						
A. Vegetation Establishment						
I. Barren Areas						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	Much of area to be repaired under current action	
6/27/2002	X			X	Inspected eastern area only, on-going construction on western half	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Eroded areas will require stabilization and revegetation.	May-05
8/26/2005		X	X		Barren areas will be temporarily seeded with rye to provide temporary vegetation until decisions on crack repair are made.	9/05 - 11/05
12/14/2005	X		X		Several small bare areas need to be seeded: area around existing tree and adjacent corner.	December 05
6/30/2006		X	X		Bare spots in several areas throughout landfill	9/05 - 2/06
10/4/2006		X	X		Bare spots in several areas throughout landfill	
2. Guinea Grass and other Invasive Weeds						
12/27/2001	X			X	Under control	
3/28/2002	X			X	Under control	
6/27/2002	X			X	Under control	
11/20/2002	X			X	Under control	
3/27/2003	X			X	Under control	
6/11/2003	X			X	Under control	
7/31/2003	X			X	Under control	
10/7/2003	X			X	Under control	
3/18/05 - 6/1/2005		X	X		Extensive growth of Guinea grass and invasive plants; these will need to be managed with herbicides and revegetation.	
8/26/2005		X	X		Continue with herbicide application and manual removal of California grass in upper cap area	9/05 - 11/05
12/14/2005	X			X	Weeds under control and no growth on cap.	
6/30/2006		X	X		Extensive growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap	
10/4/2006		X	X		Extensive growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
3. Tree Growth						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	No deficiencies observed	
6/27/2002	X			X	Inspected eastern area only, on-going construction on western half	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Several trees and tree debris located in northern area of landfill need to be removed along with dead trees outside of fence, which pose a threat to fence integrity should they fall.	May-05
8/26/2005		X	X		20-25 year old tree requires removal by HDOH and DPW as noted in AEC Performance Evaluation	Decision made to leave trees
12/14/2005	X		X		Old stump needs to be removed	
6/30/2006		X	X		Several new small trees growing on cap	9/05 - 2/06
10/4/2006		X	X		Several new small trees growing on cap	
B. Slope Failure/Slumping						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	No deficiencies observed	
6/27/2002	X			X	Inspected eastern area only, on-going construction on western half	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005	X			X	No deficiencies observed	
8/26/2005	NA	NA	NA	NA	Clearly defined boundaries need to be established for side slope inspection.	pending
12/14/2005	X		X		Side slope needs to be cleared in order to adequately inspect	pending
6/30/2006	X			X		
10/4/2006	X			X		

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
C. Cracking/Settlement						
12/27/2001		X	X		Repair scheduled for January 2002	
3/28/2002					Area under repair at time of inspection	May 02
6/27/2002	X			X	Inspected eastern area only, on-going construction on western half	October 02
11/20/2002		X	X		Cracks evident in southeast section	
3/27/2003		X	X		Cracking appears on southeastern section, need to be repaired	
6/11/2003		X	X		Cracks in southeast section, repairs recommended	
7/31/2003		X	X		Cracks in southeast section, repairs planned for 2003	
10/7/2003		X	X		Cracks in southeast section, contract for repairs awarded	
3/18/05 - 6/1/2005	X			X		
8/26/2005		X	X		Several areas along EOD access road side NE sector require filling with soil to bring back to original grade. Cracks continue to be problematic at the site. Crack repair has been halted until further clarification of procedures from the KO.	Settlement areas filled 9/05 - 11/05; repair of cracks pending
12/14/2005		X	X		Cracks greater than 1/4 inch throughout landfill	pending
6/30/2006		X	X		Cracks in many areas throughout landfill cover due to dry soil conditions	pending
10/4/2006		X	X		Large cracks in many areas due to dry soil conditions and lack of maintenance	pending

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
D. Erosion Damage						
12/27/2001		X	X		Central swale shows signs of erosion	January 02
3/28/2002		X	X		To be repaired under current action	
6/27/2002	X			X	Inspected eastern area only, on-going construction on western half	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Erosion damage along western fence and at culverts requires corrective action	May 05
8/26/2005		X	X		Several areas in NW sector require filling with soil to bring back to original grade. Areas with stabilization rock require cover with topsoil.	9/05 - 11/05
12/14/2005	X			X		
6/30/2006	X			X	No major erosion damage present on landfill cap.	
10/4/2006	X			X		
E. Debris Accumulation						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	No deficiencies observed	
6/27/2002	X			X	Inspected eastern area only, on-going construction on western half	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Primarily vegetative debris requires removal throughout site	May 05
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	No deficiencies observed	
10/4/2006	X			X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
F. Animal Burrows						
12/27/2001	X		X		Burrows found on previous inspection have disappeared	
3/28/2002	X		X		No deficiencies observed	
6/27/2002	X		X		Inspected eastern area only, on-going construction on western half	
11/20/2002	X		X		No deficiencies observed	
3/27/2003	X		X		No deficiencies observed	
6/11/2003	X		X		No deficiencies observed	
7/31/2003	X		X		No deficiencies observed	
10/7/2003	X		X		No deficiencies observed	
3/18/05 - 6/1/2005		X	X		Numerous small animal burrows throughout site require filling	May 05
8/26/2005		X	X		Fill in numerous burrows along NE and NW sector	9/05 - 11/05
12/14/2005	X		X			
6/30/2006	X		X		No animal burrows noted on the landfill cap.	
10/4/2006		X	X		Several animal burrows noted on the landfill cap, especially near fenceline	
G. Fire/Explosion Damage						
12/27/2001	X		X		No deficiencies observed	
3/28/2002	X		X		No deficiencies observed	
6/27/2002	X		X		Inspected eastern area only, on-going construction on western half	
11/20/2002	X		X		No deficiencies observed	
3/27/2003	X		X		No deficiencies observed	
6/11/2003	X		X		No deficiencies observed	
7/31/2003	X		X		No deficiencies observed	
10/7/2003		X	X		Vegetation is already coming back (from brush fire one week earlier)	
3/18/05 - 6/1/2005	X		X		No deficiencies observed	
8/26/2005	X		X		No deficiencies observed	
12/14/2005	X		X		No deficiencies observed	
6/30/2006	X		X		No deficiencies observed	
10/4/2006	X		X		No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
4. Gas Monitoring/Control System						
A. Well Casing and Cap						
12/27/2001	X			X	Intact and fully functional	
3/28/2002	X			X	Intact and fully functional	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005	X			X	Intact and fully functional	
8/26/2005	X		X		Repaint all 9 well casings due to rust	9/05 - 11/05
12/14/2005	X			X	Access to wells is adequate	
6/30/2006	X			X	All gas probes accessible, but vegetation growing back from prior clearing	
10/4/2006	X			X	All gas probes accessible, but vegetation growing back from prior clearing	
B. Protective Casing						
12/27/2001	X			X	Intact and fully functional	
3/28/2002	X			X	Intact and fully functional	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005		X	X		Wells 4/6/7/8 require cover repair. Well 6 requires additional sand inside protective casing to stabilize the probes.	August 05
8/26/2005	X			X		
12/14/2005	X			X		
6/30/2006	X			X		
10/4/2006		X	X		Exterior casings slightly deteriorated	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
C. Grout Seal						
12/27/2001	X			X	Intact and fully functional	
3/28/2002	X			X	Intact and fully functional	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005	X			X	Intact and fully functional	
8/26/2005	X			X	Intact and fully functional	
12/14/2005	X			X	Intact and fully functional	
6/30/2006	X			X	Intact and fully functional	
10/4/2006	X			X	Intact and fully functional	
5. Groundwater Monitoring System						
A. Monitoring Wells						
1. Well Casing and Cap						
12/27/2001	X			X	Intact and fully functional	
3/28/2002	X			X	Intact and fully functional	
6/27/2002	X			X	Intact and fully functional	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005	X			X	Intact and fully functional	
8/26/2005	X		X		Clear vegetation around each of the 4 monitoring wells	9/05 - 11/05
12/14/2005	X			X		
6/30/2006	X			X		
10/4/2006	X			X		

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
2. Protective Casing						
12/27/2001		X	X		Damage due to corrosion, does not affect operations, repairs scheduled this fiscal year	2002
3/28/2002		X	X		Damaged by corrosion but does not affect operation.	April-02
6/27/2002	X			X	Repairs to protective casings damage are complete	
11/20/2002	X			X	Intact and fully functional	
3/27/2003	X			X	Intact and fully functional	
6/11/2003	X			X	Intact and fully functional	
7/31/2003	X			X	Intact and fully functional	
10/7/2003	X			X	Intact and fully functional	
3/18/05 - 6/1/2005		X	X		All wells should be clearly marked with their well identification	May 2005
8/26/2005	X			X	Intact and fully functional	
12/14/2005	X			X	Intact and fully functional	
6/30/2006	X			X	Intact and fully functional	
10/4/2006	X			X	Intact and fully functional	
3. Locks						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	No deficiencies observed	
6/27/2002	X			X	No deficiencies observed	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005	X			X	No deficiencies observed	
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	No deficiencies observed	
10/4/2006	X			X	No deficiencies observed	
4. Grout Seal						
12/27/2001	X			X	No deficiencies observed	
3/28/2002	X			X	No deficiencies observed	
6/27/2002	X			X	No deficiencies observed	
11/20/2002	X			X	No deficiencies observed	
3/27/2003	X			X	No deficiencies observed	
6/11/2003	X			X	No deficiencies observed	
7/31/2003	X			X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations  
December 2001 through December 2006  
Second Five Year Review Period  
Schofield Army Barracks

Inspection of	Condition		Action Require		Comments	Date of Corrective Action
	Adequate/ Stable	Damaged/ Deteriorating	yes	no		
10/7/2003	X			X	No deficiencies observed	
3/18/05 - 6/1/2005	X			X	No deficiencies observed	
8/26/2005	X			X	No deficiencies observed	
12/14/2005	X			X	No deficiencies observed	
6/30/2006	X			X	No deficiencies observed	
10/4/2006	X			X	No deficiencies observed	

AEC - Army Environmental Center  
DPW- Directorate of Public Works  
E - East  
ft2 - Square feet  
HDOH - Hawaii Department of Health  
N - North  
W - West

Table 8.1: Issues Regarding Remedies for  
Operable Unit 2 and Operable Unit 4  
Second Five-Year Review Period  
Schofield Army Barracks

Issue	Affects Current Protectiveness?	Affects Future Protectiveness?
<b>Operable Unit 2</b>		
Concentrations and distribution of TCE and CCl <sub>4</sub> in monitoring network have changed little in the past five years. Lower monitoring frequencies may be sufficient to assure protectiveness of remedy.	No	No
The TCE concentration in Well 2901-13 has increased to greater than 2.5 µg/l for one sampling event.	No	No
Well 3-2803-01 is classified for domestic/ municipal use, which does not match actual use. However, according to DLNR records, the correct number for the well that gets sampled is 3-2803-03, which is classified for industrial use.	No	No
Well 2803-01 was incorrectly identified during three monitoring events in 2005 and was not sampled.	No (well has since been sampled)	No
Wells in network not sampled	No	Potentially (if not sampled in future)
<b>Operable Unit 4</b>		
Cracking of the landfill cover	Yes	Yes
Minor erosion and some cracking of the concrete in center drainage channel of landfill.	No	Potentially
New trees on landfill cap	No	Yes (as roots penetrate deeper)
Barren spots	Potentially	Potentially
Erosion under fence and around footings of fence posts	No	Yes (as erosion increases)
Protective housings of gas monitoring wells show signs of slight deterioration. However, the past ten years of very low methane concentrations indicate that landfill gas monitoring can be discontinued without affecting protectiveness	No	No

Table 9.1: Contingency Plan for Sampling Wells in Long-Term Monitoring Network  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Use	Depth Open Interval (msl)	Contingency if Pump is Non-Functional or if Access is Blocked or Denied
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	-40 to -150	Sample Well 2600-04 (-40 to -150 ft msl)
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	-32 to -246	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event
3-2702-05	OU 2 Offsite Monitoring Well	20 to 0	Sample Well 2702-03 (17 to -3 ft msl) or 2702-04 (32 to 12 ft msl) if either has a pump installed
3-2703-02 (Del Monte)	OU 2 Offsite Irrigation Well	Unknown	Sample Well 2703-01 (221 to -129 ft msl)
3-2800-03	OU 2 Offsite Domestic/Municipal Water Supply	-48 to -262	Sample Well 2800-01 (-40 to -250 ft msl) or 2800-02 (-40 to -250 ft msl) or 2800-04 (-40 to -251 ft msl)
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	284 to 134	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	Unknown	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-2803-01	OU 2 Offsite Industrial Well	bottom at -154	Sample Well 2803-05 (196 to -163 ft msl)
3-2803-05 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Wel	196 to -163	Sample Well 2803-01 (to -154 ft msl) or 2803-07 (42 to -118 ft msl)
3-2803-07 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Wel	42 to -118	Sample Well 2803-01 (to -154 ft msl) or 2803-05 (196 to -163 ft msl)
3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well	-40 to -160	Sample Well 2859-02 (-40 to -150 ft msl)
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	283 to 133	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	277 to 147	Use data from adjacent supply well
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 137	Use data from adjacent supply well
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 83	Use data from adjacent supply well
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 23	Use data from adjacent supply well
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 9	Use data from adjacent supply well
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	221 to 52	Sample Well 2901-12 (174 to 16 ft msl) or 2901-08 (220 to -10 ft msl)
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	174 to 16	Sample Well 2901-11 (221 to 52 ft msl) or 2901-08 (220 to -10 ft msl)
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	266 to 186	Use data from nearby Schofield Shaft Monitoring Well 2901-01 or Supply Well 2901-02
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	80 to -120	Sample Well 2902-02 (106 to 6 ft msl)
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	284 to 134	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	283 to 133	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	285 to 135	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	281 to 231	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	284 to 234	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	628 to 60	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	284 to 234	No comparable well; repair pump as soon as possible and sample in next groundwater monitoring event

Table 9.1: Contingency Plan for Sampling Wells in Long-Term Monitoring Network  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Use	Depth Open Interval (msl)	Contingency if Pump is Non-Functional or if Access is Blocked or Denied
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	217 to 175	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event
3-3102-02	OU 2 Offsite Irrigation Well	143 to -17	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event
3-3103-01	OU 4 Offsite Irrigation Well	231 to -101	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event. Efforts are currently in progress by the Army to obtain estimates for repairing this well, so that regular sampling can be resumed.
3-3203-02	OU 2 Offsite Irrigation Well	-46 to -196	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event

msl - Mean sea level

OU - Operable Unit

Table 9.2: Recommendations for Changes in Monitoring Frequency  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCL4 Trend Evaluation	Current Monitoring Frequency (as of December 2005)	Proposed Monitoring Frequency
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2702-05	OU 2 Offsite Monitoring Well	Slight increasing trend but <2.5 ug/L	<1 ug/L, stable	Annual	Annual
3-2703-02 (Del Monte Basal)	OU 2 Offsite Irrigation Well	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2800-03/3-2800-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	In the plume, >10 ug/L, but stable	<1 ug/L, stable	Quarterly	<b>Annual</b>
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	In the plume, < 5 ug/L, around 2.5 ug/L but stable	<1 ug/L, stable	Annual	Annual
3-2803-01	OU 2 Offsite Industrial Well	In the plume, < 5 ug/L, around 2.5 ug/L and decreasing trend	CCL4 concentrations increased above 1 ug/L in November 2005, <1 ug/L since then	Annual	Annual
3-2803-05 (Del Monte #3)	OU 2 Offsite Irrigation/Municipal Water Supply Well	In the plume, < 5 ug/L, > 2.5 ug/L but stable	CCL4 concentrations increased above 1 ug/L in November 2005, <1 ug/L since then	Quarterly	Quarterly
3-2803-07 (Del Monte #4)	OU 2 Offsite Irrigation/Municipal Water Supply Well	Stable, staying <1 ug/L	<1 ug/L, stable	Semiannual	<b>Annual</b>

Table 9.2: Recommendations for Changes in Monitoring Frequency  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCL4 Trend Evaluation	Current Monitoring Frequency (as of December 2005)	Proposed Monitoring Frequency
3-2859-01/3-2859-02	OU 2 Offsite Domestic/Municipal Water Supply Well	Stable, <1 ug/L. Not sampled in 2005 and 2006. Pump needs repair, otherwise should sample 3-2859-02	<1 ug/L, stable	Annual	Annual
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	In the plume, >10 ug/L, but decreasing trend	<1 ug/L, stable	Quarterly	<b>Annual</b>
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	In the plume, stable, <2.5 and <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >10 ug/L, but stable	<1 ug/L, stable	Semiannual	Semiannual
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >5 ug/L, but stable	<1 ug/L, stable	Semiannual	Semiannual
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >10 ug/L, but stable	<1 ug/L, stable	Semiannual	Semiannual
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume, >10 ug/L, had an increase in TCE concentrations in August 2005	<1 ug/L, stable	Quarterly	Quarterly
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual

Table 9.2: Recommendations for Changes in Monitoring Frequency  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCL4 Trend Evaluation	Current Monitoring Frequency (as of December 2005)	Proposed Monitoring Frequency
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	In the plume, < 5 ug/L, exceeded 2.5 ug/L in November 2006. Require two sampling results > 2.5 ug/L to increase frequency of sampling to semiannually.	<1 ug/L, stable	Annual	Annual
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	In the plume, stable around 5 ug/L with a slight decreasing trend	In the plume, stable, < 2.5 ug/L	Quarterly	<b>Annual</b>
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	Downgradient of landfill, stable, staying at or around 1 ug/L	<1 ug/L, stable	Annual	Annual
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	In the plume, stable, <2.5 and <1 ug/L	<1 ug/L, stable	Annual	Annual
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	Landfill well. >5 ug/L. Decreasing trend until August 2004, upward trend since then. Evaluate in two years increasing the sampling frequency back to semiannual if TCE >30 ug/L.	Landfill well. <5 ug/L. Similar trend to TCE. Evaluate in two years increasing the sampling frequency back to semiannual if CCL4 >6 ug/L or TCE >30 ug/L.	Annual	Annual
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	Landfill well. >5 ug/L. Increasing trend, repair landfill cap then evaluate in next sampling following cap repair	Landfill well. <5 ug/L. Similar trend to TCE.	Semiannual	Semiannual

Table 9.2: Recommendations for Changes in Monitoring Frequency  
Second Five-Year Review Period  
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCL4 Trend Evaluation	Current Monitoring Frequency (as of December 2005)	Proposed Monitoring Frequency
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	Landfill well. >5 ug/L. Staying between 20 to 30 ug/L, TCE concentrations increasing since August 2005. Evaluate after landfill cap repair.	Landfill well. <5 ug/L. Similar trend to TCE.	Semiannual	Semiannual
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	Landfill well. Increasing since 2003 but just <2.5 ug/L. Evaluate after landfill cap repair. Well was sampled semiannually by mistake in 2006, go back to annual sampling.	<1 ug/L, stable	Annual	Annual
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-3102-02	OU 2 Offsite Irrigation Well	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-3103-01	OU 4 Offsite Irrigation Well	Downgradient of landfill, stable, <1 ug/L	<1 ug/L, stable	Annual	Annual
3-3203-02	OU 2 Offsite Irrigation Well	Stable, <1 ug/L	<1 ug/L, stable	Annual	Annual

CCL4 - Carbon Tetrachloride

ug/L - Micrograms per liter

OU - Operable Unit

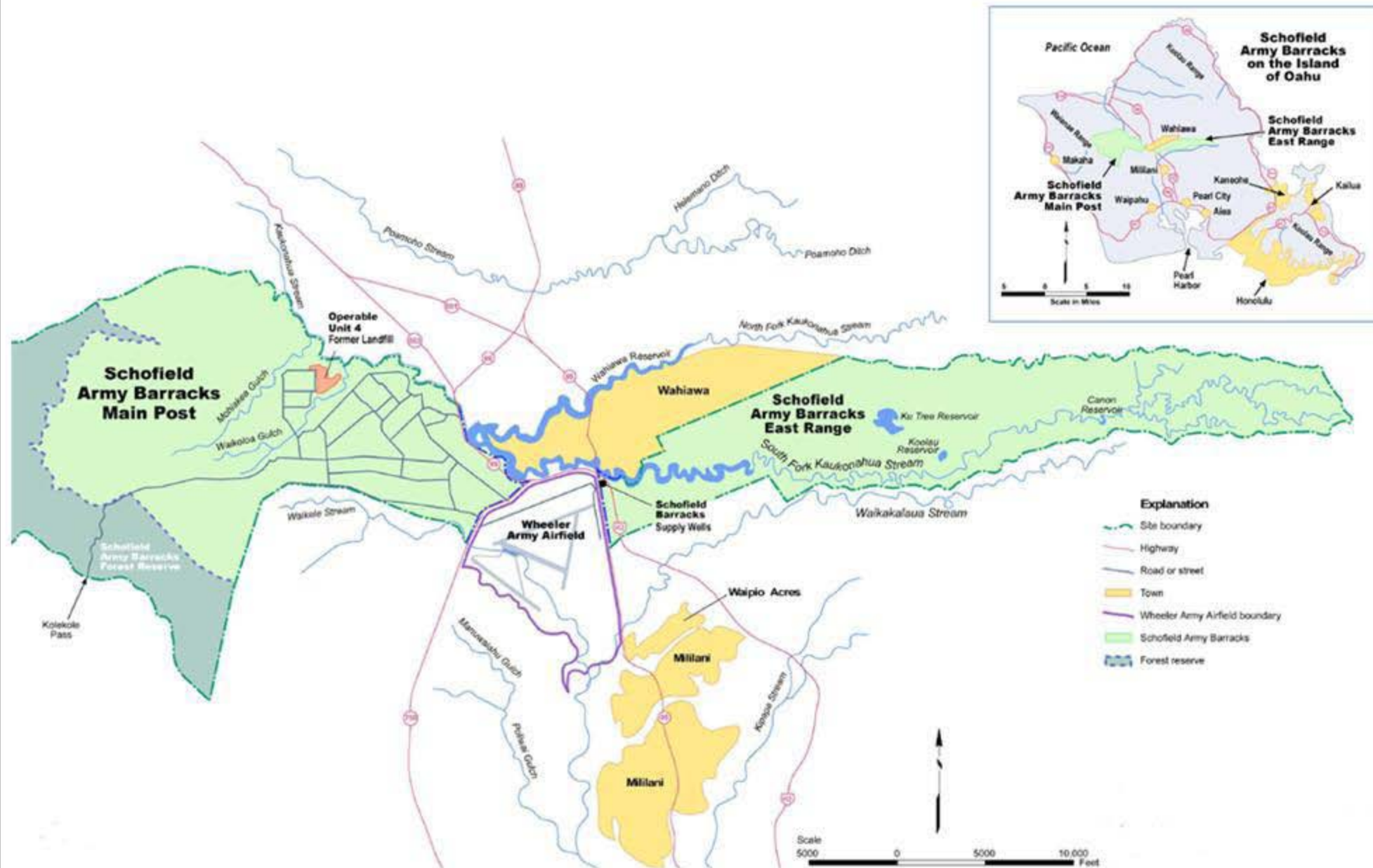
TCE - Trichloroethene

Table 9.3: Recommendations and Follow Up Actions for Operable Unit 2 and Operable Unit 4  
Second Five-Year Review Period  
Schofield Army Barracks

Issue or Deficiency	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current?	Future?
Operable Unit 2						
TCE concentration in Well 2901-13 increased above 2.5 µg/l	If concentration remains above 2.5 ug/l in next sampling event, consider increasing the monitoring frequency to semiannual	Army	State/EPA	November 2007 (next annual sampling event)	No	No
TCE concentrations in Well 3004-01 increasing slightly	If concentration rises above 30 ug/l, increase monitoring frequency to quarterly	Army	State/EPA	Ongoing assessment	No	Potentially
Well 2803-01 misidentified	Correctly mark well as 2803-03; use correct name in future sampling events and correct in database	Navy	State/EPA	May 2007	Yes	Yes
Wells in network not sampled in designated monitoring event	Develop contingency plan for sampling all wells	Army	State/EPA	Contingency plan presented in this 5-Year Review; will be implemented upon approval of report	Yes	Yes
Concentrations and distribution of TCE and CCl <sub>4</sub> have changed little in the past five years. Lower monitoring frequencies may be sufficient to assure protectiveness of remedy.	Utilizing the process shown in Figure 4.2, reduce the monitoring frequency for network wells, where appropriate. See Table 9.2 for recommendations.	Army	State/EPA	Adopt revised frequencies in next sampling event after approval of recommendations by the State and EPA	No	No

Table 9.3: Recommendations and Follow Up Actions for Operable Unit 2 and Operable Unit 4  
Second Five-Year Review Period  
Schofield Army Barracks

Issue or Deficiency	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current?	Future?
Operable Unit 4						
Cracking of the landfill cover	Continue to perform crack repair on a routine basis	Army	State/EPA	Complete repairs by July 2007	Yes	Yes
Slight erosion and cracked concrete in Central Drainage Channel	Repair cracked concrete; address erosion through one of the following: 1) regrade/revegetate, 2) install permanent erosion matting, 3) place rip-rap in affected areas	Army	State/EPA	Complete repairs by July 2007	No	Yes
Small trees growing on cap	Remove trees; Note that this does not include the large, 20-25 year old tree near the northwest perimeter of the landfill	Army	State/EPA	by June 2007	No	Yes
Guinea grass and invasive weeds on sideslopes and cap	Apply herbicides and revegetate with native grasses or in accordance with the Operations and Maintenance Plan	Army	State/EPA	by June 2007	No	Yes
Eroded areas under fence and around fence posts	Fill in eroded areas with soil or rock and repair fence post	Army	State/EPA	by June 2007	No	No
Damaged/corroding fence post	Replace fence post	Army	State/EPA	by June 2007	No	No
Protective surface housings of 4 gas monitoring wells deteriorating	Repair or replace surface housings OR discontinue landfill gas monitoring (recommended because methane concentrations have been very low or not detected)	Army	State/EPA	by June 2007	No	No

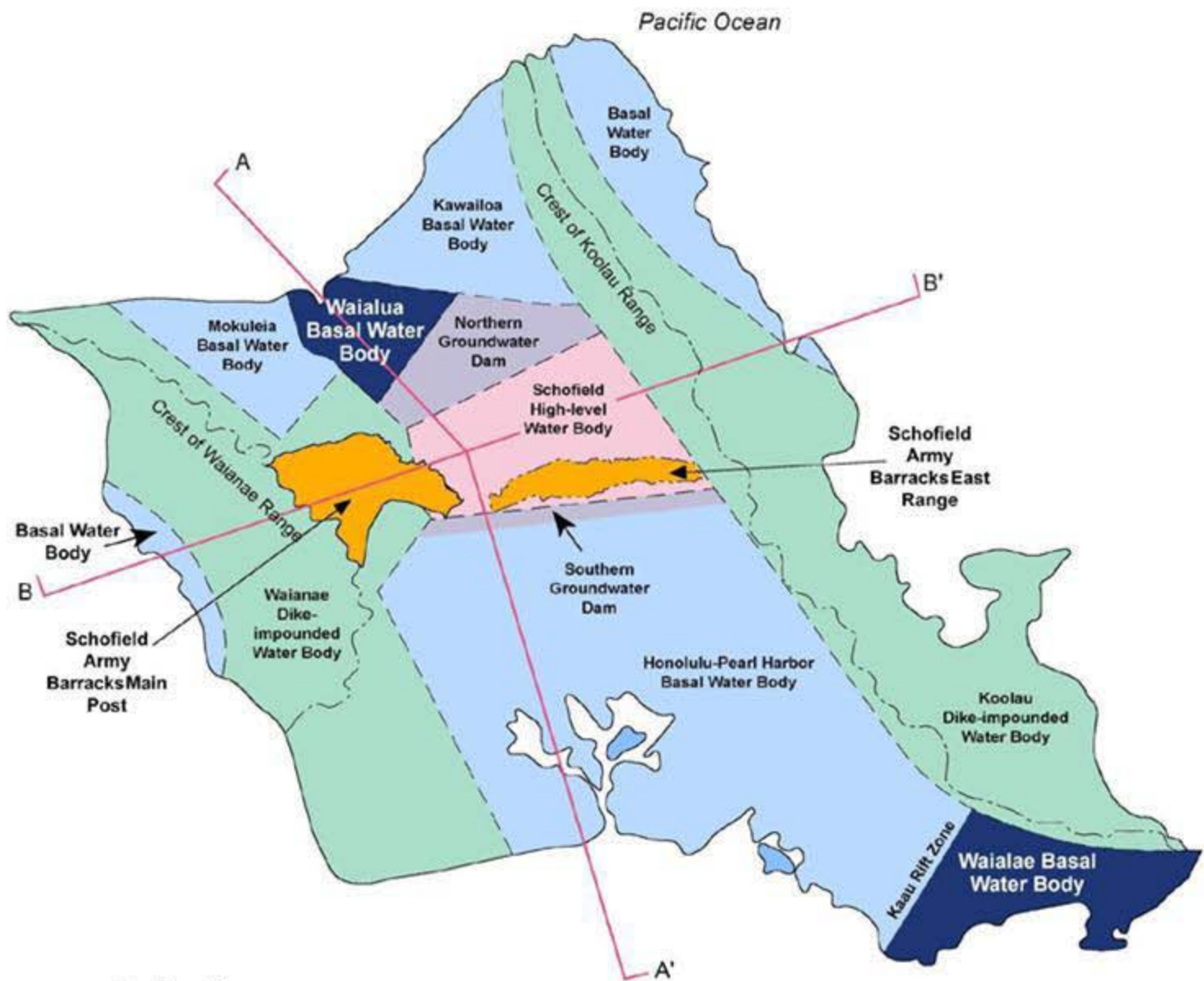


Prepared for  
U.S. Department of the Army  
U.S. Army Garrison, Hawaii

Schofield Army Barracks  
Island of Oahu, Hawaii

Figure 3.1

Site Location Map of  
Schofield Barracks



### Explanation

--- Boundary between groundwater bodies



Schofield Army Barracks



Basal Water Body



Schofield High-level Water Body



Dike-impounded Water Body



Groundwater dam

A A' Generalized cross section line

Source: Final Record of Decision (ROD) for OU 2, 1996

Cross sections are provided in the OU 2 ROD

Scale

5 0 5 10 Miles

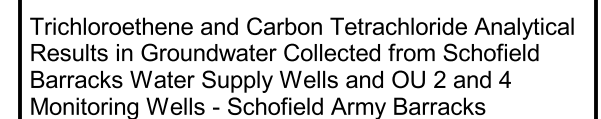


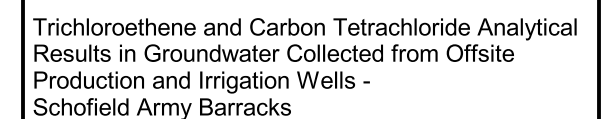
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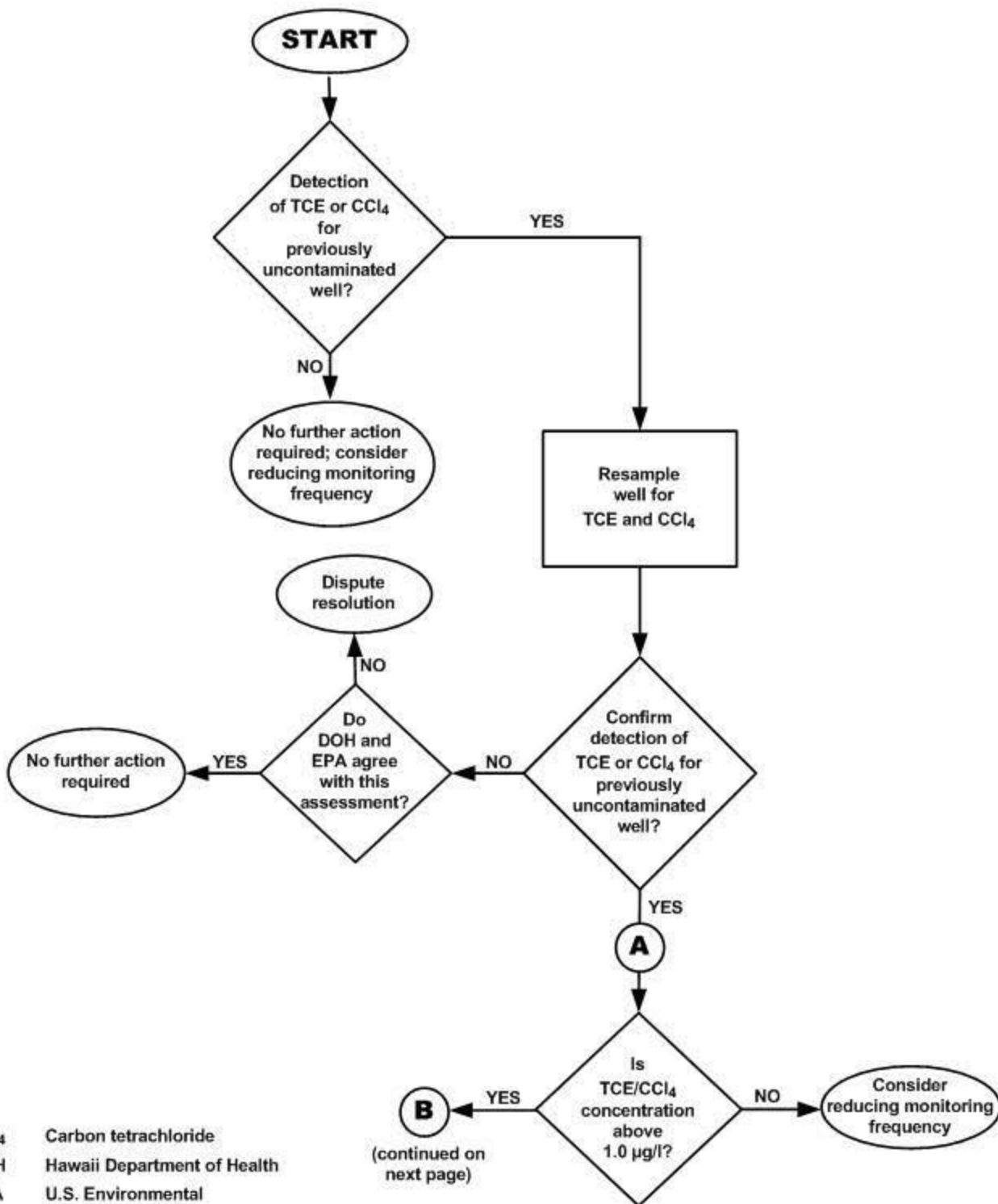
Schofield Army Barracks  
Island of Oahu, Hawaii

Figure 3.2

Regional Groundwater Systems  
of Oahu, Hawaii







CCl<sub>4</sub> Carbon tetrachloride  
 DOH Hawaii Department of Health  
 EPA U.S. Environmental Protection Agency  
 TCE Trichloroethene  
 µg/l Micrograms per liter

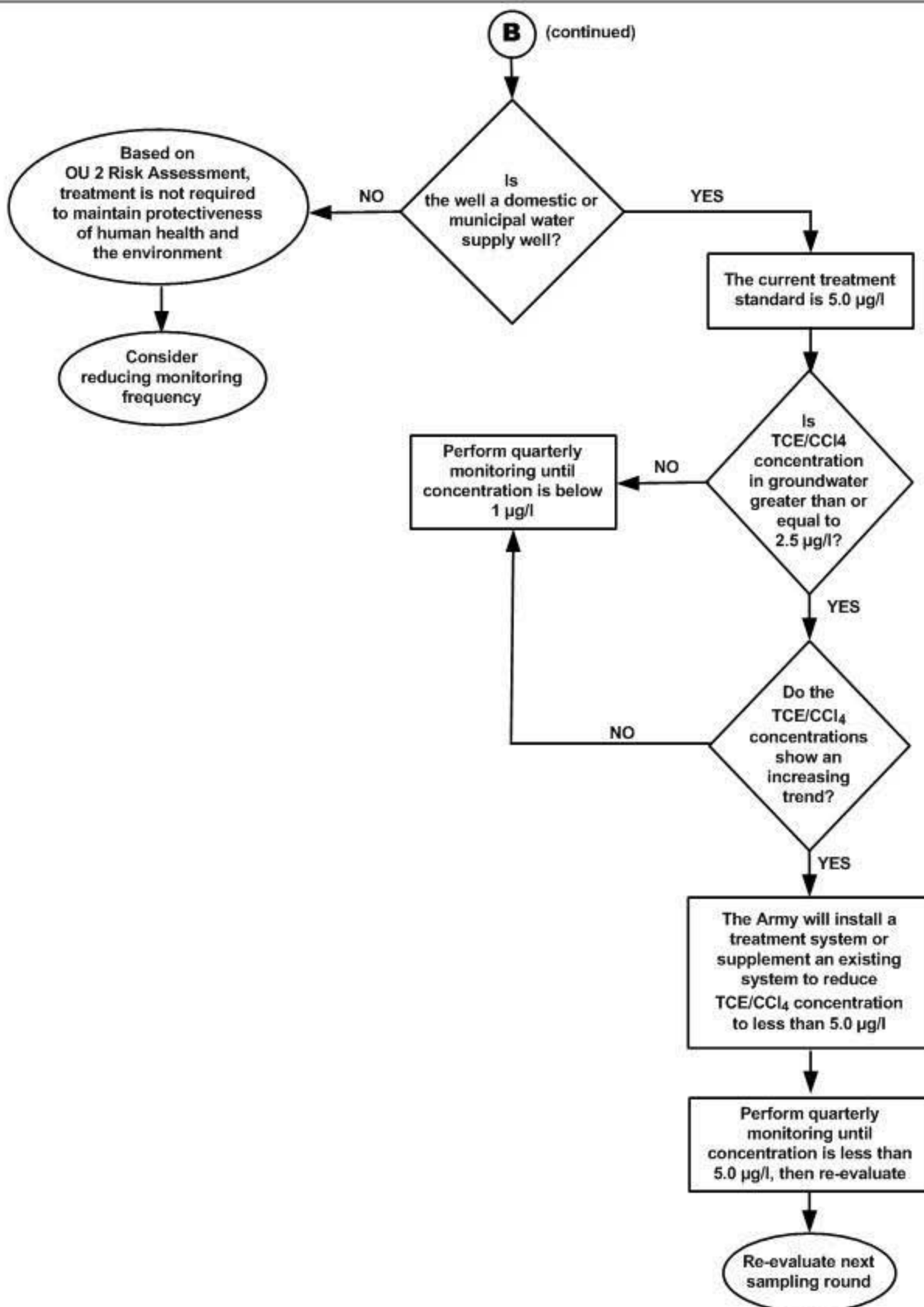


## Evaluation for Potential Wellhead Groundwater Treatment

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 U.S. Department of the Army, U.S. Army Garrison, Hawaii  
 Schofield Army Barracks, Island of Oahu, Hawaii

FIGURE

4.1



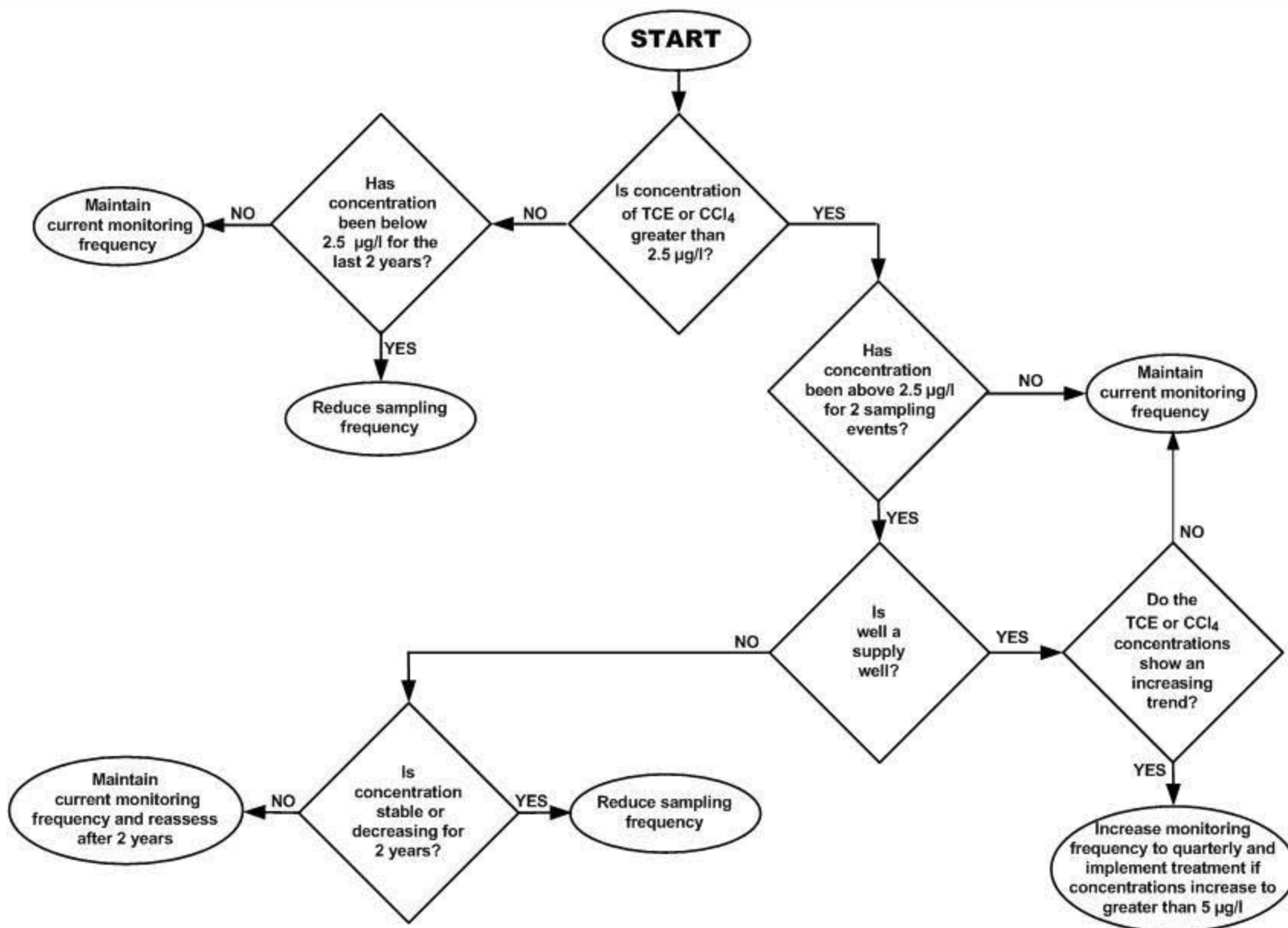
## Evaluation for Potential Wellhead Groundwater Treatment

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U.S. Department of the Army, U.S. Army Garrison, Hawaii  
Schofield Army Barracks, Island of Oahu, Hawaii

FIGURE

**4.1**

(continued)



CCl<sub>4</sub> Carbon tetrachloride  
 TCE Trichloroethene  
 µg/l Micrograms per liter



## Assessment of Changes in Monitoring Frequency

Prepared for:  
 U.S. Department of the Army, U.S. Army Garrison, Hawaii  
 Schofield Army Barracks, Island of Oahu, Hawaii

FIGURE

4.2

DRAWN  
 FBK

JOB NUMBER  
 4683070005

APPROVED  
 KLC

DATE  
 2/24/07

REVISED DATE

**Appendices for this Five-Year Review are available by placing a request using the Customized CERCLIS/RODS Report Order Form.**

**<http://www.epa.gov/superfund/sites/phonefax/rods.htm>**